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NATIONAL ELECTRICITY SUPPLY AND RECONSTRUCTION.

IN our issue of December 21st we published, and briefly commented on, a summary of the recommendations of the Coal Conservation Sub-Committee, which we described as of the first importance to the electricity supply industry. That impression is amply confirmed by a perusal of the complete report,* which was issued last week. Indeed, the matter is of such moment that we strongly urge every interested reader to procure a copy and study it for himself; as Lord Haldane remarks in a covering note to the Prime Minister, "it is scarcely possible to exaggerate the national importance of the problem of a technically sound system of electrical supply," and "it is a matter of grave national importance that action should be taken without delay." While the Report is too lengthy for reproduction in our limited space *in extenso*, we are printing elsewhere in this issue a fairly full abstract of its contents, from which it will be seen that the Sub-Committee has treated the subject on the very broadest lines, regarding the problem in the first place from the point of view of an ideal organisation, and afterwards considering the existing situation and the manner in which it should be dealt with in order to bring about an ultimate approximation to that ideal.

To put the matter in a few words, the proposition is to replace the parochial system of innumerable independent electricity supply undertakings by an entirely new organisation of national character and gigantic dimensions, supervised and controlled by a supreme Board of Electricity Commissioners, and sub-divided into some 16 districts, in each of which the generation and primary distribution of electrical energy will be entrusted to a single authority.

One cannot but admire the courage as well as the ability of the Sub-Committee which has created this colossal scheme. It proposes to reverse at one stroke the policy which has held sway for 30 years; to strike off the chains of "municipal boundaries" which, more perhaps than any other factor, have hampered the development of the electrical industry—and therefore almost every manufacturing industry—in this country; to neutralise the handicap of deficiency in water-power by the efficient and economical use of coal, facilitating the establishment of new industries in this country; and by enabling the output of manufactured products to be doubled and trebled, with the aid of electrically-driven machinery, to solve those weighty problems which at present occupy the minds of employers and workmen who look ahead to the after-war conditions. These are all admirable aims. To what extent can they be realised?

That the municipalities will regard the report as constituting a direct attack upon their cherished preserves can hardly be doubted, and it is to be regretted that it has been so phrased as to afford some justification for that inference. Lord Haldane himself, the chairman of the Coal Conservation Sub-Committee, clearly perceives this fact, and by way of anticipation remarks that it should "be kept clearly in mind that whatever conflict there may be between the interests of the local electrical authorities which exist at present and the interests of a comprehensive scheme, there is no conflict in this matter between the interests of the local community and those of the nation as a whole”; he adds that the Sub-Committee thinks it “should not be further hampered by the mistaken policy of the past,” though the necessity of paying fair compensation for existing rights and providing for the liquidation of debt is admitted. We gather from the numerous reports which we have received as to the comments of municipal representatives in the Provinces that they have already taken up an attitude of hostility towards the scheme. As we indicated in our previous remarks on this subject, the Sub-Committee shows a distinct leaning towards private enterprise, to which it attributes initiative and resource, freedom of range, and keenness, qualities “conducive to the fullest measure of success.” We also pointed out that in some areas a demand would undoubtedly be set up for some form of municipal control.

---

* "Interim Report on Electric Power Supply in Great Britain." Cd. 8,880. Price 3d. net.

The country is therefore faced with the facts that the national interests imperatively require the adoption of some such scheme as that put forward in this report; that the support of the local authorities for the scheme is essential to its accomplishment; and that, according to present indications, that support will be withheld. Is there any way out of this apparent *impasse*?

It is true that under the stress of war conditions, all of us, burgesses and councillors alike, have learnt to subordinate our individual aspirations to the national needs, and to accept the arbitrary decisions of the duly constituted authorities with more or less docility; but little can be done towards carrying the scheme into effect while the war endures, no matter how urgent it may be, and therefore its fruition must be deferred till peace returns. In these circumstances, the powerful influence of the local governing bodies will again assert itself, and no elected Government can over-ride their opposition rough-shod. Hence, to our mind, it is a prime essential to convince them of the absolute necessity of a complete departure from our present policy, as all electrical engineers are already convinced on technical grounds, and no time should be lost in proving to them beyond all doubt that the national interests can be served in no other way, that their local interests will not suffer, and that they will still remain for the most part masters in their own houses. They must part with the functions of generation and primary distribution, but from the sub-station to the consumer they should retain both ownership and control, and to this policy the Sub-Committee offers little objection.

The question of the constitution of the District Electricity Supply Authority, however, will remain to be disposed of, and we foresee that the municipalities, in spite of the satisfactory experience of Tyneside, will never consent to the installation of a private company in this capacity, no matter what safeguards and systems of financial control may be put forward in mitigation of the offence. In short, no organisation that pays dividends under any circumstances need be considered. To meet the views of the municipalities and remove their objections, some form of public control is indispensable. Fortunately we have, in the Hydro-electric Commission of Ontario, a striking example of such a system of control, which has achieved a remarkable degree of success, and has shown that it possesses in large measure those administrative qualities which the Sub-Committee specifies as indispensable. Under the rules of the Commission, the municipalities of Western Ontario enjoy precisely those advantages which it is the object of the Sub-Committee to secure for this country (though the source of energy happens to be water instead of coal), with the result that Toronto, for instance, is *par excellence* an electrical city. This is, we believe, the line of least resistance, as well as the line which conforms most closely to the trend of present-day ideas, which cannot be ignored. Frankly, for our own part, we should prefer a company under statutory control, such as that which was in course of evolution for London, with the concurrence of the L.C.C., when war broke out; but we foresee so many and great obstacles to the adoption of this principle in the Provinces, that we believe it wiser to adopt the second-best plan on the score of expediency.

Here we must leave the subject for the present, but we may direct attention to the views of various authorities summarised in our “Notes” columns to-day, and we hope on a future occasion to comment on some of the technical features of this interesting report.

“Control” After The War.

Sir Albert Stanley, President of the Board of Trade, delivered an instructive speech to the deputation of the Association of Chambers of Commerce the other day. The deputation was interviewing him for the purpose of explaining objections to the Imports and Exports (Temporary Control) Bill. The desire of all traders is for trading operations to be freed from the influence of Government control as speedily as possible after the end of the war. The Board of Trade, according to Sir Albert's reply to the deputation, has devoted very careful consideration to the period of changing over from war control to normal freedom of operation, and its desire is for control to be ended as soon as possible. The official view is that the period need not be a very lengthy one, yet “just as the machine has been gradually wound up, so must it be gradually unwound.” Too hurried a transformation might stop the machine altogether. Control will be gradually relaxed, and industry and trade will be able to re-establish their position and eventually go “unfettered.” These observations must not be given a wider application than was intended by the speaker. They related to the particular measure that formed the subject of the interview—the resrictions on imports and exports. There may be a sense in which we shall never be able to return to the industrial freedom, however limited we may have thought it to be, of the days before the war, but, so far as import and export trade is concerned, it is interesting to learn from Sir Albert that though the Board has inserted a period of three years in the Bill, it does not contemplate for a single moment that the present restrictions in the aggregate will continue for such a period, and it will use its best endeavours to decide ultimately upon some period which will give general satisfaction. It is obvious to those who are trying to take a broad view of the whole situation as it will emerge when the happy, anxious days of Peace arrive that this subject must be affected to a very large extent by the tonnage position. The demands on all the available tonnage for returning the Forces to this country, to the Colonies, and to the States, for bringing in raw materials and food for ourselves and our Allies, and neutrals, and possibly, according to Peace terms, for starving enemy countries, will form a “first charge.” Importation and exportation of raw materials and food form, of course, a large part of the general movement back to the normal state of affairs, but, even when we are not fighting, there will have to be some measure of regard paid to what materials and products are, and what are not, immediately essential for the well-being of the nations interested. There must therefore, be some general plan which will involve Government control for a time to assure that what are really the first things come actually first, and in order that food shortage, unemployment, and chaos may be avoided at what is bound to be a time of extreme crisis.

JOINT BOXES AND TERMINALS FOR SPLIT CONDUCTOR CABLES.

The success of the Merz-Hunter protective system, particularly in the case of E.H.T. electric light and power installations, is undoubtedly resulting in the increased use of three-core split conductor cables of concentric formation for three-phase work, this form apparently being the most popular of the several alternative methods of arranging the split conductors (see fig. 1).

But it has been found that whereas prospective users of this system are generally fully acquainted with the principles upon which it is based, they are not always fully advised as to the best method of jointing and terminating the special cables made use of, and therefore a few remarks upon this subject may be of general interest, especially as improper jointing may render the system ineffective.

To arrange the feeders so that the split conductors of each phase have equal impedance, the cable may be divided into a number of convenient lengths, the inner conductors of one length being connected to the respective outer conductors of the adjacent length.

This arrangement also prevents interference with the equal division of current between the two conductors of each phase by unequal inductive effects due to out-of-balance currents in the feeder itself, and to currents in adjacent feeders or earth.

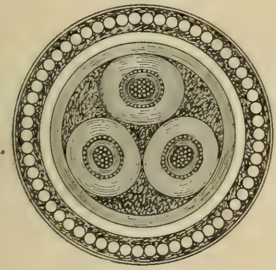
Fig. 1.—Section of Three-core Split-conductor Cable.

It will be seen that a special form of joint is called for, but excellent results have been obtained from a joint of simple construction, which has given every satisfaction up to 20,000 volts working pressure, and is made up as follows :—

After stepping back the lead and insulation in the usual way, two short lengths of braided copper of a total section equal to one of the conductors are bound and sweated to each inner conductor ; the two pieces of copper braid are then threaded through apertures provided in the hard-wood separators (fig. 2), the ends of the inner conductors being separated from one another by a diaphragm left solid in the centre of the wood block, and are bound and sweated to the outer conductor of the adjacent length. The braid lies loosely along shallow grooves on the outside of the separators, expansion and contraction of the conductors thus being also provided for (fig. 3).

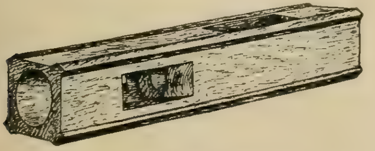
Fig. 2.—Hard-wood Separator.

The joint on each phase is then surrounded by a paper tube, the three tubes of the completed joint being bound together, centralised by means of spreaders, fig. 4, and the whole enclosed in a lead sleeve and filled up solid with insulating compound in the usual manner.

Joints made in the manner described by jointers of ordinary experience in E.H.T. work, having no special knowledge of the requirements of split-conductor joints, have withstood 15,000 volts between split conductors for five minutes and 100,000 volts between phases and between phases and earth for 15 minutes, at a temperature of 176° F.

Special apparatus for terminating split-conductor cables has been devised by the majority of firms who specialise in this class of work, but one design only which is known to have given complete satisfaction will be dealt with in this article.

The terminal box in question is the outcome of extensive experiments carried out with the object of discovering the most efficient means of complying with a stringent specification, issued in connection with the protective system under consideration ; it successfully withstood a test of 100,000 volts for 15 minutes between phases and between each phase and earth and 15,000 volts between split conductors for five minutes.

As will be seen from the illustration (fig. 5), the terminal box is provided with a new type of bottle-shaped porcelain insulator, which was developed to resist the concentrated stress set up within and around the insulators, owing to the positions they necessarily occupy in relation to the conductors. These porcelain insulators support the special fittings and insulators, Patent No. 106,573/1917 (fig. 6), by means of which the conductors are separated, and which make it possible to reduce the size of the terminal to the dimensions of an ordinary terminal box for three-core, three-phase E.H.T. cable.

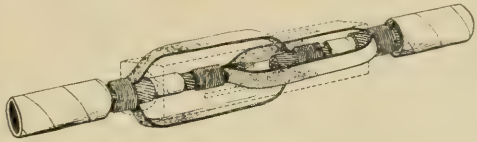
Fig. 3.—Arrangement of Joint.

The method of jointing, as is apparent from the illustrations, is particularly simple, the apparatus being so designed that after stepping back the lead and insulation in the usual manner, the cores may be cut off two or three inches above the top of the porcelain insulators ; a paper reinforcing tube is then placed in the position shown, and taped to each phase. The insulation on each phase is removed in accordance with the illustration (fig. 6), and the looping fittings are connected to the copper tubes, bound and sweated to the outer conductors. The porcelain insulators, being designed to pass over these fittings, are next placed in position, the sockets for the outer conductors being clamped to the tops of the copper tubes, which now form the outer conductors. The tubular portions of the insulators separating the split conductors are then inserted into the copper tubes, and the special screwed jointing ferrules (provided with diaphragms in the centre to prevent moisture creeping down the strand) secured by means of grub screws, and sweated to the inner conductors of each phase, which should be sweated solid. The topmost portion of the smaller insulator is next placed in position, the whole arrangement being finally secured by tightening down the knurled nut provided on the screwed portion of the ferrule terminating the inner conductors. The box is partially filled with compound by means of the

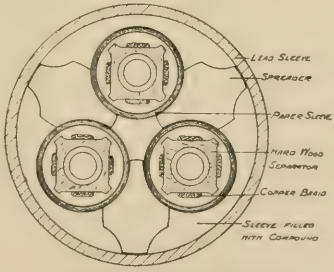

Fig. 4.—Section of Joint.

oval cover provided in front of the box, the top of the box and the porcelain insulators being filled with compound by means of a head of compound maintained in a funnel provided for the purpose to a height sufficient to seal the paper insulation on the cores; this height is determined by the height of the funnel and vent pipe, both of which are removed after contraction of the compound has taken place. The space above the compound level forms expansion chambers, which allow for the expansion of the compound filling under working conditions, an air vent being provided in the knurled nut.

It will be noticed that the box itself has solid walls at the top to prevent compound leaking under any circumstances, and to facilitate the fixing of insulators, while the bottom portion of the box is split at the centre line, so that the cable can be arranged in the back half of the box after the insulation has been removed from the cores without the trouble of threading it through a hole in the casting. The screwed brass wiping gland is arranged so that it can be bolted up between the top and bottom portions of the box after the wiped joint has been made, the gland being secured by means of a special nut provided with earthing lugs; the wire armouring is secured and earthed on to the brass gland by means of malleable iron grips.—J.

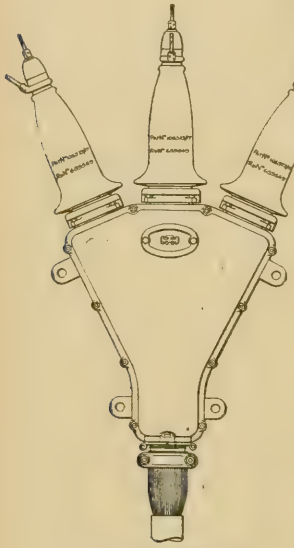

Fig. 5.—Terminal Box.

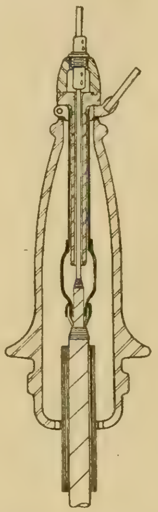

Fig. 6.—Section of Special Terminal.

REMINISCENCES.—I.

By "EX-SHIFT DOG."

The monotony of shift work in power houses has been the theme of many a growl at various times, but looking back over some few years so spent, there are many incidents and episodes which are vividly remembered as being exciting and by no means lacking in variety. Priming boilers, machines running away or burning out, intermittent recurring short-circuits, and occurrences of that nature, are certainly not every-day events, but they do happen occasionally, and undoubtedly break the monotony of an otherwise routine but strenuous existence. Many other items of smaller importance also tend to destroy any tendency to vegetate, and it is these affairs from which the most useful lessons can often be learnt.

Episodes of both great and small significance frequently also have their humorous aspects. During the never-to-be-forgotten railway strike of 1912, for instance, a certain power house was guarded against possible attack by regular soldiers of undoubted valour, for inflammatory meetings were expected to be held upon a neighbouring common. Just within the big doors and a little to one side peacefully hummed a 1,000-kw. rotary converter, one of the first of the self-synchronous type put to work in this country; a group of soldiers often lounged about the open door when off duty, while the sentry continued his stolid tramp outside. A heavy short caused the usually good-tempered rotary to flash over badly one day with several thousands of kilowatts capacity behind her. The worthy soldiery, although they doubtless would have faced (and, perhaps, since have done so) the worst of Krupp's "frightfulness" cheerfully, broke and fled, overcome by such unexpected and little-understood noise, smoke, and confusion; and even the sentry took cover behind the wall, probably expecting to see the whole place collapse amid thunder and lightning. Although the writer was exceedingly busy for a quarter of an hour after this occurrence, the spectacle of the khaki-clad figures dashing away in all directions still lingers very plainly in his memory.

Many less noisy episodes take place which are never reported. A night shift at a small A.C. station was run by a reciprocating engine set and a water-tube boiler of very liberal capacity compared with the load carried. The staff consisted of a charge engineer, a driver, and a fireman. The two former became engrossed in the wee sma' hours in an inspection and discussion of some new machinery, and trusted to their hearing that all was well with the plant, until they were startled by the apparition of the fireman running into the engine room and shouting: "Look out for your volts; I've let the fires out!" The driver rushed to his engine, the charge engineer and stoker back to the boiler house. Steam was already back to 100 lb. instead of 150, and the last remaining fire was disappearing over the dumping bars. The pawl drive of the mechanical stoker had slipped and driven the fire forward at a prodigious speed, which had escaped the notice of the fireman until too late. Energy and a supply of oily waste averted a shut down, but the volts were low and the frequency more so, in spite of the cut-off gear being set at its lowest. The steam chart was easily "faked," the volt chart passed without comment, and the fireman—given his chance—developed into an excellent and reliable man.

The prevalency of the practice of "faking" is dying out, it is to be hoped, but still one occasionally meets cases of its deliberate retention. A certain CO_2 recorder would to-day give the same result—a convincingly varying line—if it were supplied with fresh air in lieu of flue gas, and an ingenious cardboard strip, intended to facilitate the reading of a vacuum gauge at a distance, can be so placed that its weight causes the indication of at least 2 in. extra vacuum: but these are exceptions, and, apart from the honesty of the *personnel*, the adoption of stricter supervision and of checking recorders has made faking more difficult than in the past.

It is the usual practice to run the most economical plant the longest possible periods, and in one case the largest unit had also the lowest consumption, even at the light night loads. Consequently this set, a turbo-alternator of 1,500 kw. capacity, frequently ran for several weeks at a time. At the end of a week it was found, however, that the circulating pump and air pump motors, which were D.C., required attention to their brush gear and commutators. It came to be the practice, therefore, to run another turbine, and motor this unit for half-an-hour or so each Sunday morning while having the pumps shut down. At first the Tirrill regulator, normally on the big set, was carefully taken off and transferred to the extra machine, but after a time, someone with the courage of his convictions motored the unit, and allowed the Tirrill to continue its work by means of wattless motoring currents, an arrangement which was perfectly satisfactory in practice. The switchboard was fitted with both ammeters and kilowatt meters, and the latter had a set-up zero, so that it was possible to read directly the reverse power required to drive the turbine (a matter of about 200 kw.) and at the same time to watch the Tirrill regulation upon the fields, and the circulating currents between the machines. The operation of synchronising the second set, motoring the big unit, and, after the pumps had received attention and been restarted, changing back to normal, could thus be done without causing the slightest departure from the usual straight voltage record which the Tirrill provided. The writer has not heard of any other instance in which a regulator is kept on a motoring machine as a matter of routine; but, of course, it is nothing wonderful theoretically, and may possibly be done elsewhere.

Circulating pump motors are occasionally troublesome, in so much as they are often somewhat inaccessible, usually very reliable, and so do not receive much attention. Vertical shaft motors with centrifugal pumps have sometimes been installed, and are a useful precaution when the engine room or condenser pit is below the level of a neighbouring river or canal. In one case during the erection of some new plant a large and heavy valve was dropped by accident upon cast-iron circulating pipes; the condenser pit was below the level of the canal, and the pump motors were flooded out, causing a complete shut-down. In another case, a circulating pump refused to start in an emergency, and merely blew its fuse repeatedly upon attempting to operate the starter. An investigation showed that a greaser cleaning around it with more zeal than knowledge that same morning had broken the shunt lead between pole windings. Steam-driven condensing plants are neither so economical nor so suitable in other ways for power stations, but in the modernised form they are coming into general favour again on account of their reliability.

In large plants the auxiliaries are nearly always driven at high speed by small and independent turbines, a very compact and simple arrangement, and not so wasteful as might appear, since the exhaust steam is afterwards used either in the main turbine or for heating the feed water. A small steam-driven condenser, dealing with the exhaust from other pumps, fans, &c., had an annoying habit of stopping—a not uncommon failing of that particular type of reciprocating engine—and, moreover, was naturally run almost dead slow when on auxiliaries only. While stopped, the condenser became considerably water-logged, of course, and if not very carefully drained before restarting (and time was precious), used to eject hot water from its relief pipe to a moderate height and thoroughly drench the devoted person of the engineer at its stop-valve. The motor-driven set at this station was a condenser outfit for a 500-KW. turbine, driven by a reputed 30-H.P. motor, single-phase, and of weird design, having commutator and slip-rings, and consuming 17 amperes at 2,000 volts at all loads!

Reverting to electrical matters, one sometimes comes across curious arrangements of gear and occasionally lamentable ignorance among attendants. The writer was once asked by the attendant in sole charge of a 1,000-KW. sub-station near London, containing E.H.T. remote-control gear, rotaries, and a fairly complicated D.C. switchboard, for an explanation of the working of the rotaries' transformers; he was obviously suspected of joking when he mentioned casually that, of course, there was no direct connection between the primary and secondary. "How, then, can the electricity get through to the rotary?" was asked protestingly. Yet that attendant carried out his duties by rule of thumb quite satisfactorily, and, at the time, was earning nearly 50 per cent. more salary than the writer, besides being his senior by quite 15 years. On the same undertaking the E.H.T. bus-bars were of polished copper, and had to be regularly vaselined in order to prevent oxidisation! Further, the fuses for the D.C. bus-bar voltmeters were installed close to the instruments, so that when a selector switch broke down, as one eventually did, there was no check to the short-circuit until the 3/20 cable fused, causing considerable burns to the person operating the switch. Ammeters were also mounted with bare terminals for shunt leads in such a position that the earthed arms of a "Navy-'phone"-type telephone could easily reach them, with disastrous results to the instruments.

In another station a rotary converter was separately excited by a small D.C. generator, belt-driven from it, and the belt was exposed and without guides or strikers; although this was supposed to be a temporary expedient, it remained in use for over 18 months to the writer's knowledge. During that time the belt came off on sundry occasions, and caused considerable variations in the supply, if not actual shut-downs. In yet another station the staff once solemnly filed up the commutator of a high-speed exciter while it was standing!

SOME NOTES ON COAL TESTING.

By G. W. STUBBINGS.

The large proportion of the total cost per unit represented by fuel in even the most modern and efficient electricity works has now directed attention to the fact that the calorific value of coal is a factor of prime importance in determining the price that should be paid for the same. As coal is really a form of potential energy, the practice of buying coal by weight, although unavoidable, is not, strictly speaking, logical. Thus it is customary to insert a clause in coal contracts requiring a specified minimum calorific value, and not infrequently a sliding scale is adopted, by which the price to be paid depends upon the calorific value. This very necessary procedure has necessitated the systematic testing and analysis of the various consignments of coal as they are delivered, and this testing has frequently to be carried out by those to whom this class of work is none too familiar. The operations of analysing and testing coal really require a more or less thorough training in technical chemical work; but a conscientious man who has had some experience in laboratory work can, after a little practice, obtain very good results.

Directions more or less detailed are to be found in all the standard text-books on technical chemistry. There are, however, several points that may be useful to those undertaking fuel testing in central stations—points which, perhaps, are too familiar to those trained in chemical work to require mention in the text-books, but are not so well known to electrical men.

The complete test of a sample of coal usually comprises an approximate analysis to determine the percentages of moisture, volatile matter, fixed carbon, and ash, and also a direct determination of the calorific value of the fuel by burning a small quantity in a suitable calorimeter. A determination of the percentage of sulphur is sometimes made; but this is not usual, or frequently called for. If it be required, directions are to be found in all the standard text-books, and the process is quite straightforward to those competent to carry out the usual analysis.

A word may first be said regarding the directions for obtaining a legitimate sample of the fuel to be tested. The directions as given in the books seem to the uninitiated to be superfluous and tedious. It cannot, however, be too strongly urged that unless the most careful attention is paid to these directions, all the subsequent work may be quite useless. The chance shovelful taken from the truck that sometimes suffices, is absolutely useless as a sample. The full directions should be carried out if results worthy of the name are required. The method of preparing the sample is also of the highest importance, and the coal must be ground sufficiently to pass through a sieve of the requisite fineness. Great care should be taken that no specks that have failed to pass through the sieve are inadvertently mixed with the final sample.

For the determination of moisture a weighed sample, from 1 to 2 grammes, is dried at a temperature of 110° C. for half-an-hour. The sample is then cooled in a desiccator and weighed. The drying is continued for a further quarter-of-an-hour, and the sample is then weighed again. This is repeated till the weight does not further diminish; it may rise slightly owing to oxidisation, but in this case the lowest weight is taken as the correct one. It is important that the drying temperature be not above that given; at a temperature even moderately higher, decomposition takes place, and some volatile constituents are given off. No attempt, therefore, should be made to hasten the process by raising the temperature. It is, moreover, absolutely necessary to cool the sample in a desiccator. The desiccating agent necessary is concentrated sulphuric acid, which acid should be renewed at regular intervals, and before it shows signs of discoloration. It should be borne in mind that the sample of coal, after drying, is in a condition rapidly to absorb moisture from the atmosphere, and that, unless a desiccator be used, the result will be of little value.

A determination of surface moisture should be made if the sample, as taken from the trucks, has been surface dried before preparation. This test is made by exposing a weighed sample of the coal, as taken from the trucks, to a temperature of 70 F. for 24 hours. A correction for this surface moisture will have to be made to the final analysis.

The determination of the volatile constituents and of the ash is fairly straightforward. In testing for ash the process of ignition is sometimes hastened by occasionally allowing the crucible to cool, thereby allowing air to be drawn into the interstices of the heated mass. It is also possible, with care, so to arrange the position of the crucible as to obtain a slight movement of air across the coal, the combustion being thereby hastened. This draught must, however, be very slight, or some of the ash will be blown out of the crucible. The weighing and re-heating in the ash test must be repeated till a constant weight is obtained. The appearance of the sample is no guide as to the degree of completion of the ignition, the only sure sign being constancy of weight after 10 minutes' re-ignition. Cooling must take place in the desiccator, as the highly porous ash will absorb moisture with avidity.

The direct determination of the calorific value of the fuel is carried out by burning a weighed quantity in a calorimeter, and observing the rise of temperature of a known quantity of water. In some calorimeters the oxygen necessary is passed directly into the combustion chamber; in another system the oxygen is supplied by intimately mixing with the coal a definite quantity of sodium peroxide. Owing to the heat of the subsidiary chemical actions taking place with this method, the actual weight of coal used is less than the nominal, in order that this extraneous heat may be compensated for. In view of the complexity of the chemical action between the coal and the sodium peroxide, and its possible variation with the class of fuel being tested, it would seem that this method is not one yielding results of the highest accuracy. It possesses, however, the important advantages of simplicity of working and cheapness of equipment, and while the results are not, perhaps, quite so good as those obtained with a more expensive apparatus, they are, nevertheless, very useful when obtained by a careful observer.

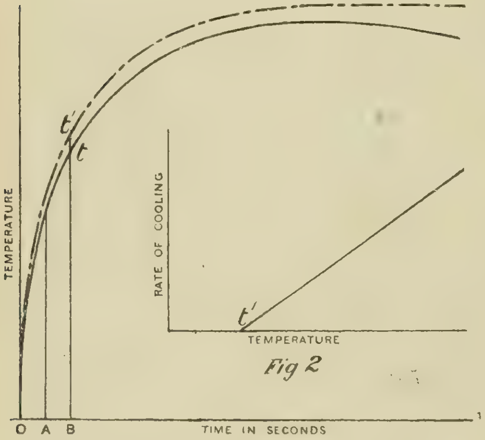

Fig 2

Fig 1

Figs. 1 and 2.—Heating and Cooling Curves.

As the range of the temperature of the water in the calorimeter is small, not usually much over 10° C., it follows that the initial and final temperatures must be observed with great care if accurate results are desired. The water in the calorimeter must be stirred till the reading of the thermometer is constant, before the combustion is started. After the combustion of the coal the water must be constantly stirred, and the reading of the thermometer carefully observed till it begins to fall. Until the fall of temperature commences there is no certainty that the whole heat of combustion has been communicated to the calorimeter and its contents. As some considerable time is taken for the final temperature to be reached, it follows that, as the calorimeter is during this time above the temperature of the surrounding air, it is constantly losing heat.

This loss of heat can be greatly reduced by standing the calorimeter on some non-conducting substance, and by having its exterior brightly polished. A correction for loss of heat by radiation can, however, be made with considerable exactness, and if results of a high degree of accuracy be aimed at, this correction may well be applied. The procedure is as follows: From the moment the combustion is complete, readings of the thermometer are taken at regular intervals of, say, 20 seconds, till the temperature begins to fall. Two readings are now taken at an interval of two or three minutes, and from these readings the rate of fall of temperature in degrees per 20 seconds can be obtained for the temperatures intermediate between these two readings. According to Newton's law of cooling, this rate of fall of temperature is proportional to the excess temperature of the calorimeter over that of the surrounding air. A curve of rate of fall of temperature can now be constructed, as fig. 2, the temperature t', at which the cooling is zero, being, of course, that of the surrounding air, and the curve being a straight line between a point corresponding to these conditions, and another point corresponding to the observed rate of cooling at the maximum temperature. The original time and temperature readings are now plotted, and a curve is obtained similar to fig. 1. The average temperature during each 20 seconds' interval being obtained, the fall of temperature during this period is obtained from fig. 2, and this loss of temperature is added to the temperature ordinate corresponding to the termination of this interval. Thus, the fall of temperature corresponding to the temperature at a time A being found, this amount is added to the ordinate B t to give a new ordinate B t'. By repeating this for each 20-sec. interval a new curve is obtained with a flat top, the flat portion corresponding to the constant temperature that would have been attained had there been no cooling, and giving the corrected final temperature.

It should be remembered that throughout the whole of the analysis and test of the fuel, patience and methodical procedure are most likely to obtain accurate results. Chemical work is very different from electrical, and the speed with which electrical measurements can be observed offers a great contrast to the comparatively lengthy process of even an elementary chemical examination. Bearing this in mind, and conscientiously following the directions given in the standard text-books, the ordinarily well-trained electrical man should obtain results good enough to enable the purchasing of coal to be managed on a rational and scientific basis.

NATIONAL ELECTRICITY SUPPLY.

Interim Report of the Coal Conservation Sub-Committee.

In our issue of December 21st we published a summary of the interim report of the Coal Conservation Sub-Committee of the Reconstruction Committee on Electric Power Supply in Great Britain, which was prepared by a sub-committee appointed to deal with Power Generation and Transmission.

The complete report which has now reached us is exceedingly interesting, and we think that very few of those who have studied the problem of electricity supply in this country will be disposed to disagree with the broad principles enunciated therein.

The following extracts will be of interest:—

Summary.—The coal consumption involved in the production of motive power in the United Kingdom amounts at the present time to 80,000,000 tons per annum, equivalent in value to, say, £40,000,000 at pit head.

In the industrial reorganisation which must take place on the termination of the war the further development of power is of great importance. The present use of motive power per employé is only about half that in the United States of America.

It is only by largely increasing the amount of power used in industry (by two or more times) that the average output per head (and as a consequence the wages of the individual) can be increased. Power may be most efficiently applied to industry by the medium of electricity.

Technically and economically the electrical energy can be best provided by a comprehensive system, as may be amply proved from experience gained in those parts of the world where such systems are in existence, notably in Chicago (Illinois), on the North-East Coast of England, on the Rand, and in certain industrial districts of Germany. Power production in large super-plants, with generating machines of 50,000 H.P. or more, will not only be far more economical than in a large number of smaller plants, but will ultimately involve great economies of capital by securing a better load and a more effective use of the plant. Such super-plants, if suitably situated on large sites, would make it possible—so far as it was economical to do so—to extract the by-products in the shape of oils, motor spirit, &c., from the coal before using it as fuel, thus avoiding to a large extent the necessity of importing them.

The super-plants would feed into the main trunk distribution system, which must be laid down throughout the country. For this purpose the country should be divided into some 16 districts, throughout each of which there should be a standard periodicity and trunk main voltage.

This main trunk distribution system would collect any waste power available wherever situated, and deliver it where it could be profitably used. It would also, by saving the cost of transport, make it commercially possible to bring much coal to the surface, which is at present wasted and left in the pit, and which under the new conditions would be turned into electrical energy at or near the pit head.

The saving in coal throughout the country would, in the near future, amount to 55,000,000 tons per annum on the present output of manufactured products.

If the coal so saved were used for the production of further power it would be possible to generate continuously not less than 15,000,000 H.P., which would more than compensate for the absence of large water powers in this country, and admit of the manufacture here of many products which are at present only made in America and on the Continent.

The present system of electrical power distribution throughout the country, which is undertaken by over 600 authorities in as many separate districts, is technically wrong and commercially uneconomical. The present average size of generating station is only 5,000 H.P., or about one-fourth of what should now be the smallest generating machine in the power station. The "Power Act" legislation inaugurated some 15 years ago has not had the desired result on account of the restrictions imposed upon the power companies.

A national system of electric power supply would greatly facilitate the electrification of railways with its attendant advantages, save large sums of money at present spent on the transport and distribution of coal, and bring within reach of the community as a whole the great benefits of an increase in the use of electricity for domestic purposes, advantages which, taken together, are perhaps of more value than the direct coal saving.

It is estimated that to-day the production of power, including railways, absorbs at least 80,000,000 tons of coal.

The average coal consumption per horse-power hour throughout the country has been halved during the last 25 years. In spite of this, the total amount used has increased. A consideration of the probable future development of British industries shows that it is *not so much by reducing our total coal consumption as by increasing our industrial output for a given coal consumption that progress will be made.* Unless this result is attained we shall be faced with the necessity of doubling our coal output or reducing our coal exports to nothing. *But the present coal consumption would, if used economically, produce at least three times the present amount of power.*

It is obvious that improvement in the commercial prosperity of a country—that is to say, the average purchasing power of the individual—depends on increasing the output per head.

Now it is possible to increase the output per head by harder work on the part of each individual, but there is far greater promise in increasing his output by giving him more machinery to multiply the effectiveness of his efforts.

The following table from the Census of Production shows the extent to which output is dependent upon the use of power:—

Average net output, per head.	Males, per cent. of all employed.	Females, per cent. of all employed.	H.P. of engines at factories, per 100 employed. In all establishments.	In factories.
Under £50	31·9	68·1	21	92
£50 and under £75	40·0	60·0	50	67
£75 " £100	72·4	27·6	97	118
£100 " £125	90·2	9·8	100	189
£125 " £150	98·0	2·0	266	269
£150 " £175	64·0	36·0	81*	89*
£175 " £200	92·0	8·0	215	221

* The small amount of power used per hand employed is explained by the fact that this group includes trades such as the tobacco industry, where a large proportion of female labour is employed.

In the United States the amount of power used per worker is 56 per cent. more than in the United Kingdom—if we eliminate workers in trades where the use of power is limited, or even impossible, we shall probably find that in the U.S.A. the use of power, where it *can* be used, is nearly double what it is here. The best cure for low wages is more motive power. Or, from the manufacturer's point of view, the only offset against the increasing cost of labour is the more extensive use of motive power. The solution of the workman's problem, and also that of his employer, is the same, viz., the greatest possible use of power. Hence, the growing importance of having available an adequate and cheap supply of power produced with the greatest economy of fuel.*

One question which has been settled conclusively during the past 15 years is that the most economical means of applying power to industry is the electric motor. In the factories put down for the production of munitions during the war, 95 per cent. of the machinery is driven by means of electricity, and it is only a question of time for all power to be applied in this way. Thus, the problem is not so much how to apply the power to the tool or process, as the case may be, but how best to generate the electric power.

Broadly speaking, there are two alternative methods, namely, what may be termed the *individualistic method* and the *collective method*. In the first case, each manufacturer generates his own electric power, generally in a power station situated in his works; in the second the power requirements of a large number of individuals, in fact, of the community, are pooled and dealt with collectively.

In the case of the individual method the plants are small, occupied for a small portion of the day only; as a consequence, the capital cost is of undue importance as compared with the cost of coal, with the result that cheaper and less economical plant is used since it pays to save money in capital and spend it on coal.

In the case of the collective method, the economy of carrying out electrical transmission on a large scale enables the plant to be placed on a site offering the best water and transport facilities—conditions essential to economy. The pooling of loads admits of the use of large electrical generating machines, which is also essential to economy, and the load is of such a nature that the number of generating machines in operation can be regulated to suit the requirements of the load throughout the day. Due to the absence of coincidence of the requirements of the various factories supplied, the amount of energy produced per horse-power of plant installed is much greater. As a consequence, the cost of coal is the predominating factor in the total cost, and installation of the most economical plant is justified. The natural tendency in the case of the collective method is, therefore, to concentrate on coal economy; on the contrary, the tendency in the case of the individualistic method is to economise in capital and waste coal, especially in a country like England, where coal is relatively cheap.

Now it is certain that arrangements ought to be made in the near future for the manufacture in the United Kingdom of many products necessary for the development of the industrial community, which are not now made here, and which require large amounts of electric power at very low cost. In any case, after the war plants will have to be erected for generating power cheaply in order to deal with these processes, and it is submitted that the opportunity should be taken for combining those plants with the plants necessary for the supply of the general power requirements of the country. This would reduce the cost of electric power to a minimum for both purposes, and, what is perhaps more important, free a large amount of the coal output for use in the generation of electricity for these special processes. The two must be done together. There should be no delay in the erection of such plants, but the sites should be chosen so as to admit of the "super-power stations" which it will be necessary to erect being also suitable for working in with a power system for the whole country.

If the manufacturer can obtain a reliable supply of power as cheaply, or more cheaply, from an outside source than by putting up plant himself, he is able to save his capital for use in his own particular trade. Moreover, power can be delivered to the individual manufacturer with greater economy in the use of coal from a collective system than from a series of individual plants, for the economical generation of electricity implies the use of large prime movers, and the economical size of generating machine is substantially larger than the requirements of any one of the largest factories.

It is broadly true to say that, as regards the country as a whole, the requirements of each municipal area, each railway, and each factory are dealt with separately, with the result that the average size of generating machine employed is certainly not more than a tenth—and probably not more than a twentieth—of what it ought to be. Under such conditions, economy in coal consumption is impossible.

A conspicuous example of the necessity of the multiplication of individual power plants, which has arisen from the fact that no large central supply was available, is afforded by the recent addition to the power stations of London of eight railway power stations, of an average capacity of 24,350 KW., within a distance of four or five miles from Hammersmith, in addition to 21 other power stations already existing.

With the exception of Lots Road, all these additional stations are badly situated as regards water facilities, and they might all have been advantageously combined on one site with great economy of capital, labour, and coal.

The position of large local authority undertakings in the Midlands is most unsatisfactory. Their power station sites have been primarily selected from the point of view of retaining the works within the city areas, so that the "rates" on such works may be retained by the operating local authority. None of the undertakings of Birmingham, Liverpool, Manchester, or Sheffield have sites with proper water and condensing facilities. The whole of these undertakings use cooling towers. These undertakings generated during the last 12 months between 600 and 700 million units. While the present position is most unsatisfactory, the future expansion of these undertakings gives rise to still greater apprehension. Important extensions on new sites are already projected, the additional plant proposed aggregating some 300,000 kw. to 400,000 kw. In the case of Birmingham, the new site chosen is within the city boundary; and the condensing facilities are limited to cooling towers, and owing to shortage of water supply raw sewage effluent will have to be used for "make up" purposes. In the case of Sheffield, the new site, which is the subject of a Parliamentary inquiry, adjoins the city boundary, and cooling towers for dealing with a 50,000-kw. demand will have to be used during long periods of the year.

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* Unless cheap power is available the tendency must be to develop those industries where the output per head is small rather than those, such as, for instance, electrochemical products, where the output per head is large—industries which are daily becoming of increasing national importance.

If power* is to be supplied throughout the country at the lowest possible price, the following conditions must be secured:—

1. The power users in each industrial district must be supplied from one common inter-connected electrical power distribution system.

2. Large generating machines, not less than 20,000 h.p., must be used, and they must be erected in the best possible positions for economical production. In the more important industrial districts generating machines of 50,000 h.p. might be advantageously used.

3. Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. N.B.—As regards waste coal—*i.e.*, coal which it does not at present pay to bring to the surface—this could, where transport was the ruling consideration, also be used on the spot.

To-day, if a colliery owner has small and poor coal in his colliery which it does not pay him to bring up because it cannot stand the freight, or a coal of high calorific value, but too friable to stand transport, he cannot under existing conditions contemplate turning it into electricity at the pit's mouth—extracting the by-products in doing so—because, except in certain areas where a trunk main system exists, there is no market for the electricity, there being no means of transmitting or distributing it.

There are important additional advantages to be secured from the erection of plants on roomy and efficient sites rather than on crowded and inefficient sites, apart altogether from those resulting from the increase in the size of the plant.

Apart from the saving in fuel, centralised power production is essential if the capital charges and labour costs are to be reduced to a minimum.

At the present time the supply of electricity in Great Britain is dealt with by some 600 undertakings. The average generating plant capacity of those undertakings which have power stations is 5,000 h.p., or about one-fourth of the capacity of one single generating machine of economical size, and about one-thirtieth of the size of what may be considered as an economical "power station unit." The following table gives some particulars of electricity supply in London:—

London Electricity Supply. Position in 1913.*

	Central area.	Greater London.
No. of authorities	39	70
No. of generating stations†	41	70
Average size of stations	7,646 kw.	5.285 kw.
Average size of units	787 kw.	632 kw.
No. of types or systems of generation	31	49
No. of frequencies	8	10
No. of voltages { generation	20	32
No. of voltages { distribution ...	21	24
No. of methods of charging and prices	50	70

* Slight changes have taken place since 1913, when the above table was prepared for the L.C.C., but it has not been considered necessary to revise the table since the general situation remains unaltered.

† In addition, there are nine traction stations within the Greater London area, eight of which are within the Central Area.

It is not suggested that a scheme of power distribution for the whole country can be treated as an ordinary engineering project and commenced *de novo*, but it is urged that the time has now arrived for the matter to be considered comprehensively, and for the reorganisation of the existing indiscriminate power supply systems to be undertaken on correct lines. The main transmission system must be alternating current, three-phase, at a high voltage—no engineer would dispute it—but a more difficult question is that of frequency; in Great Britain no less than 10 frequencies are employed to-day.

A division of England and Scotland into areas having frequencies of 50, 40, and 25 cycles respectively represents the least amount of scrapping of existing plant consistent with development on right lines. Roughly speaking, England, south of a line between the Humber and Carlisle, could be run at 50 cycles, with the exception possibly of the Black Country between this line and the Cheviots might remain at 40 cycles whilst the whole of Scotland could be standardised at 25 cycles. The chief difficulties are, however, not technical ones, but what may be called political.

In order to illustrate the inefficiency of the present system, a list of the average prices received in the Lancashire industrial district is given in the following table, and compared with the average price paid by consumers on the North-East Coast.

Average Prices Charged to Consumers by Electricity Undertakings in the Lancashire Area.

	Private supply. Pence per unit.	Public lighting. Pence per unit.	Traction supply. Pence per unit.	Total supply. Pence per unit.
Liverpool Corporation ...	1·82	1·88	1·13	1·50
Manchester Corporation ...	1·02	2·11	1·03	1·02
Eccles Corporation ...	2·17	2·18	1·13	1·71
Salford Corporation ...	1·31	1·35	1·27	1·29
Stretford Corporation ...	2·27	1·14	1·13	1·49
Stockport Corporation ...	·90	·50	·55†	·80
Bolton Corporation ...	1·03	—	1·10	1·05
Bury Corporation	·67	2·24	1·08	·72
Heywood Corporation ...	1·30	3·00	1·25	1·29
Leigh Corporation ...	1·65	—	—	1·65
Rochdale Corporation ...	1·33		1·01	1·20
Wigan Corporation ...	1·50	2·26	1·19	1·38
Ashton Corporation ...	·72	1·37	1·22	·85
Oldham Corporation ...	1·42	1·99	1·50	1·44
Stalybridge Joint Board ...	·67	1·10	·50	·66
Accrington Corporation ...	1·12	2·59	1·75	1·15
Blackburn Corporation ...	1·63	1·95	1·39	1·58
Burnley Corporation ...	2·00	1·11	1·18	1·49
Colne Corporation... ...	2·25	1·00	1·63	2·00
Darwen Corporation ...	1·22	3·17	1·27	1·29
Nelson Corporation ...	2·68		2·00	2·42
Rawtenstall Corporation...	1·16	2·69	1·23	1·03
Middleton Corporation ...	1·31	4·35	1·32	1·32

† Does not include any capital charges.

The figures as to the cost of electrical energy throughout this important industrial area may be compared with those for the North-East Coast district of England, where the entire area, somewhat larger in actual square mileage, and much smaller in population and in power requirements and, therefore, less advantageous from a supply point of view, is served by a group of power companies from one inter-connected electrical distribution system. The average price paid for electrical energy is less than ½d. per unit, and the use of electric power per head relative to the population is three times as great.

(*To be concluded.*)

ILLUMINATING ENGINEERING.

By A. P. TROTTER.

(*Extracts from Presidential Address to the* Illuminating Engineering Society.)

When our members are called upon to advise on the lighting of some place or building, or to carry it out, they examine the conditions and consider the requirements; they recommend the most advantageous method, and calculate the appropriate arrangement of lamps. If the job is one of some importance, a specification is drawn by a consulting engineer, tenders are invited, the best one is selected, a contract is made, and the work is carried out by a contractor. The results are checked by a photometer, and the client is told that the job is finished. Then he comes and judges whether the lighting is "good or bad" merely by using his eyes! This is one of the difficulties of our branch of engineering, and its warns us not to rely too much on rules and formulæ, and that we must interpret the readings of the photometers with discretion. The instrument may make a definite statement, but we must consider the context.

The eye only is the judge. Even if an instrument should one day be invented which would indicate a quantity of light on a scale like a thermometer, our client's opinion of the lighting will not be materially influenced. Illuminating engineers must therefore give some attention to the subjective and to physiological interpretations of sense-impressions.

The National Illumination Committee of Great Britain is a body affiliated to the International Commission on Illumination. It was constituted in 1914 by the co-operation of our Society with the Institution of Electrical Engineers, the Institution of Gas Engineers, and of the National Physical Laboratory, to carry on and to develop the work which had been begun by the original International Photometric Commission.

The Committee has given preliminary consideration to a uniform international method of rating and marking all sources of light, and to the nomenclature of photometric terms. It invited a number of laboratories and private individuals to investigate the relation between the height of the flame of a Hefner amylacetate lamp and its luminous intensity, with the object of settling the height at which it would give a light equal to one international standard candle, that is to say, to 1.111 times the light of the usual 40 mm. flame. Five reports were received, and these, together with an American paper and Liebenthal's original work, gave a mean result of 44.2 mm. for the height of the flame. Excluding two for special reasons, the remaining five are within the range of half a millimetre, or about two per cent. of light. While this is a satisfactory performance for a lamp introduced so long ago as 1884, it is not sufficient for scientific work of precision.

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* The use of electricity for motive power purposes has been specially emphasised, but electrical smelting and electro-chemical processes are becoming increasingly important. They have, however, only been developed to a small extent in this country up to now, due to the fact that it has not been possible to obtain electrical energy at a low enough price. The electric refining of steel, among other matters, is known to be urgent. In addition, there are the various domestic uses of electricity, such as heating, cooking, and power, which are capable of rapid development.

It is not possible at the present time to discuss freely the desirability of darkening the streets of towns during war time as a protection against air raids, or the degree or mode of darkening if this is considered advisable.

The original anti-air defences of London were hurriedly thrust upon the Admiralty, and there was no time to go into new and difficult questions, and, of course, there was no experience to give warning of the accidents which did in fact result from over-darkening. The need for some modification soon became apparent. In November, 1916, I was sent for, and was asked to consider certain points which were put before me, and, with an officer of the London district, I inspected various parts of London in which the lamps had been obscured in various ways. In one street I measured an illumination considerably less than one-ten-thousandth of a foot-candle. I was asked to consider how much light could be allowed without revealing the topography of the district. In order to study the question more carefully, I was invited to make an aerial reconnaissance from a balloon at night.

A stiff east wind was blowing, and threatened to carry the two balloons which ascended to the west. They were therefore so ballasted that we shot up at once to 3,500 ft., where we found ourselves in the calm which sometimes lies between an east wind and a higher reverse current. There was plenty of time to study the lighting over a district of some five or six miles in diameter. The night was clear, cloudless, and moonless. The most striking feature was the unmistakeable contrast between the black river and parks and the dim shimmer of the gloomy houses. Innumerable windows with drawn blinds gave the appearance of a granular film of brightness nearly equal to that which would have been produced by an illumination of 0.1 foot-candle. At that date, the streets were easily traceable by the patches of light below the screened lamps. The sight was very beautiful, and it is sufficient to say that the authorities are of opinion that it is impossible to hide such a city as London by reducing the street-lighting. On the other hand, this does not apply to small towns, for, during a run of 40 miles into the country, after the waning moon had risen, at the trailing height of 350 ft., it was impossible to distinguish between houses and haystacks. A small town and several villages were crossed without being seen. I can confidently assert that it is possible to obliterate a small town by extinguishing all street lamps and by careful shuttering and screening of the windows. But this screening must be intelligently carried out.

In the warfare of the future we must expect surprise attacks by large air squadrons. It will be necessary for engineers to consider the best means for control of street lighting, and, indeed, of all outdoor lighting, from the source, and provision for immediate extinction, when called upon by the military authorities to take this step. An independent street lighting system affords an excellent method of giving warning of an air-raid at night. There are very few instances of separate mains for street lighting, but a relay system for the control of electric lamps has been successfully tried, and seems to be applicable for this purpose. It must be remembered that our coast towns, and indeed those near the coast, are visible from a considerable distance at night in peace time. Enemy aircraft, deprived of the guiding lights of towns, have often hopelessly lost their way, and have scattered their bombs on open fields. Complete darkening of the whole country is undesirable for many reasons, even if it were possible, but a carefully considered reduction of lighting is in many cases well worth much inconvenience and some risk of accidents.

THE FARADAY SOCIETY.

AT the December meeting of the Society a miscellaneous collection of papers was discussed, concerned mostly with problems of applied physical chemistry. The most important to the engineer was that contributed by Mr. ALEXANDER L. FEILD, United States Bureau of Mines, on "The Viscosity of Blast-furnace Slag and its Relation to Iron Metallurgy."

The paper records a brilliant experimental research undertaken by Mr. Feild; the construction of an apparatus in which the viscosity of molten slag can be measured at furnace temperatures, namely, up to some 1,600 deg. C. The method is an adaptation of that of Margules used for the viscosity of liquids. In the form adopted by Mr. Feild, it consisted essentially of two concentric cylinders of Acheson graphite, of which the outer one, containing the molten slag, was rotated at one revolution per second, when the torque exerted on the inner one, really a graphite rod hanging on a steel suspension ribbon, was a measure of the viscosity of the fluid between them. A mirror on the suspension system recorded with great accuracy the amount of twist, and hence the viscosity, once the law of the apparatus was known and it had been calibrated against a viscous fluid, such as castor oil, of known viscosity. To maintain the slag and the viscosimeter at high temperatures the apparatus was contained in an electric furnace of the granular carbon resistance type, the heating zone being 3 in. in diameter and 6 in. long, and the outer furnace shell 14 in. in diameter and 18 in. long. The large size of the latter allowed of high heat insulation. The resister material was held in the zone between two concentric alundum tubes, surrounded by magnesite chips, and outside of all kieselguhr for insulation. Graphite ring electrodes brought the current into the heating zone from a transformer giving voltages ranging from 40 to 100, the maximum current being 110 amperes. The atmosphere of the furnace, like that of the hearth of a blast furnace, was a mixture of carbon monoxide and nitrogen. The temperature of the slag was measured by means of an optical pyrometer of the Holborn-Kurlbaum type, sighted directly upon the surface of the rotating slag.

Measurements were made with eight types of commercial slags, and also some synthetic slags, at a temperature of 1,500 deg. C., and the viscosities varied from 230 to 480 (H_2O at 20 deg. C. = 1). The relation between viscosity and temperature was also studied, the curves connecting them being found to approximate to rectangular hyperbolas. The high viscosity of slag can probably be chiefly attributed to its silica content; anyhow, a very high silica content is certainly accompanied by high viscosity. Examination of quartz crystals by Bragg's method of X-ray analysis points to an unusually complex structure, three silica molecules being associated with each point of the space-lattice. This polymerisation tendency must be the fundamental cause of the extreme viscosity of silica and of the high viscosity of silicate combinations.

The practical applications of these measurements and their further consideration are obvious. The fuel economy of a blast furnace is to a great extent dependent upon the fluidity of the slag, for this must attain a certain value before the FeS can diffuse from the iron into the slag, and the CaS formed diffuse away with sufficient rapidity to prevent the reverse reaction, that is to say, before desulphurisation can take place and iron be produced. A slag requires a minimum temperature of 1,400 deg. C. to attain a working fluidity; no iron will be produced in the furnace unless the temperature distribution is such that it can acquire this temperature.

The work so far recorded by Mr. Feild is merely an indication of the importance of the subject, and its bearings on metallurgy. The wider aspects of the problem of slag viscosity and its effect upon desulphurisation are now engaging the attention of the Bureau of Mines, and further reports will be awaited by metallurgists with considerable interest.

The Concentration of Sulphuric Acid.—An interesting application of physical principles to further industrial efficiency was described by Prof. ALFRED W. PORTER, F.R.S., in a paper on "The Thermal Properties of Sulphuric Acid and Oleum."

The existing data on heats of solution and dilution, and evaporation of these acids apply only to atmospheric temperatures. War requirements have necessitated their being concentrated at high temperatures in enormous quantities, and the question of small improvements in efficiency has become of financial importance. Prof. Porter has ingeniously extended existing data to temperatures of 200 deg. C. and over by indirect methods, either from vapour pressure by means of Clapeyron's formula or from thermal capacities. The values obtained are tabulated and represented on charts in such a way as to be readily available for factory practice.

The other papers presented were chiefly of chemical interest.

The next meeting of the Society will take place on January 14th, 1918, and will be devoted to a general discussion on "The Setting of Cements and Plasters."

ANNUAL GENERAL MEETING.

The annual general meeting was held on December 12th. The resignation of the Treasurer, Dr. F. Mollwo Perkin, who had acted in that capacity since the formation of the Society in 1903, was received with much regret. Mr. Robert Mond, F.R.S.E., was elected as his successor. The following officers and members of Council were also elected:—

President: Sir Robert Hadfield, Bart., F.R.S.

Vice-Presidents: W. R. Bousfield, K.C., F.R.S., Prof. F. G. Donnan, F.R.S., Dr. Eugene Haanel, Prof. A. K. Huntington, Dr. T. Martin Lowry, F.R.S.

Council: W. R. Cooper, Dr. C. H. Desch, Dr. J. A. Harker, F.R.S., Emil Hatschek, Cosmo Johns, Prof. Alfred W. Porter, F.R.S., E. H. Rayner, A. Gordon Salamon, Dr. George Senter, Cav. Magg. E. Stassano.

The report of the Council stated that in spite of adverse conditions the past year had perhaps been one of the most fruitful in the history of the Society, whether measured by the interest of the meetings held, the value of the work published, or its activities in the wider field of scientific and technical progress.

Early in the year the Society presented a memorandum to the Ministry of Munitions on the production of synthetic nitrogen compounds, and as an outcome of a conference which took place between representatives of the Society and of the Munitions Inventions Department of the Ministry, a Nitrogen Products Committee of the Department was formed.

The Society has presented to the Department a series of sectional reports on many of the aspects of the problem under consideration, drawn up by Messrs. W. R. Bousfield, W. R. Cooper, E. Griffiths, F. M. Perkin, and F. S. Spiers, and it has also initiated some experimental work.

The Society is conducting a research on "The Setting and Disintegration of Salts and other Crystalline Substances," for which it has received a grant from the Department of Scientific and Industrial Research.

General discussions held in the course of the year included one on "Methods of Obtaining High Temperatures in the Laboratory," and another on "Refractory Materials," which proved to be a function of outstanding importance, attracting widespread interest.

In conjunction with other Societies, the Faraday Society was instrumental in calling together a conference to discuss means for carrying into effect a scheme of co-ordination between the various bodies interested in refractories research and standardisation. Later in the year a second conference was held, which resulted in the appointment of a Provisional Organising Committee to draft a scheme for a proposed Association for Refractories Research for the consideration of the industries concerned.

WAR ITEMS.

Light and Power: A War Regulation.—The following is a new Regulation which has been published under the Defence of the Realm Act:—

> 11A. The Minister of Munitions, with a view to maintaining or increasing the supply of light, heat or power for the purpose of the production, repair or transport of war material, or any other work necessary for the successful prosecution of the war, may by order direct that lights of any specified class or description shall be extinguished or their use restricted to such extent, between such hours, within such area, on such premises, and during such period as may be specified in the order, and if any person having control of any light, or occupying, or having control of, or managing, or being in charge of premises in, on, or in connection with which any light is used acts in contravention of any such order he shall be guilty of a summary offence against these regulations:
>
> Provided that this regulation shall not apply to any light required to be kept lighted by a competent naval or military authority, or other officer authorised by him for the purpose, or under any order made under Regulation 11 by the Secretary of State, or the Secretary for Scotland

Tramways in War-time.—The following new Regulation has been issued under the Defence of the Realm Act:—

> After Regulation 7BB the following regulation shall be inserted:—
>
> 7BBB. (1) The Board of Trade, for the purpose of making the most efficient use of the materials or plant belonging to a tramway or light railway undertaking with a view to the successful prosecution of the war, may by order require the whole or any part of the rolling-stock, materials and plant, including permanent way, of any such undertaking to be placed at their disposal or at the disposal of any person or body of persons named by them.
>
> Where any such order has been made the Board or any such person or body of persons may take possession of such portions of the rolling-stock, materials or plant of such undertaking as they may require, and may remove them and make use of them for the purposes of any other tramway or light railway.
>
> (2) Any order made under this regulation may be revoked, extended or varied as occasion requires.
>
> (3) If any person fails to comply with the provisions of any order made under this regulation or wilfully hinders or impedes the execution of any such order he shall be guilty of a summary offence against these regulations.

Electrical Restrictions at Rome.—A new set of regulations controlling the use of electricity for lighting and heating has just been issued by the municipal authorities at Rome. Exits of theatres, concert halls, &c., will only be allowed one lamp, not exceeding 60 watts. The present lighting of shop windows and show cases is to be reduced by 50 per cent., by discontinuing half of the lamps at present in use, and keeping the candle-power of the remaining half at the present value. No further extensions will be permitted, either by changing the C.P. of the lamps or otherwise, in the heating and lighting installations of shops, offices, public buildings, &c. The use of current for heating is forbidden between 4 and 10 p.m.

Exemption Applications.—An appeal was made at Leicester for an electrician at a local kinema (C 3), previously rejected, who is substituting a Class A man now in the Navy, and who has undergone an operation for appendicitis and peritonitis. Exemption was refused.

At Radcliffe (Lancs.), exemption was applied for an assistant electrical engineer, apprenticed to a firm doing practically all Government work, and who had been discharged from the Army after four months' service. The appeal was refused as from the end of January.

The Lancaster Tribunal have granted six months' exemption to an electrical installation engineer (42, C 3), who is in charge of the installation at a mansion converted into a military hospital.

At Southampton, the Corporation tramway department appealed for exemption for five employés. The manager said that substitutes—discharged Army men—had been sent, but they left. One was given six months with a view to substitution, and the others were each temporarily exempted for a similar period.

West Kent Appeal Court has granted one month's exemption to H. W. Whitaker (18, Grade 3), assistant electrician at the Theatre Royal, Chatham.

Before the East Kent Appeal Court, exemption was claimed for H. G. H. Dearle (39, C 1), stoker, with the Isle of Thanet Traction & Lighting Co., Ltd., and he was given until June 17th.

An appeal was made by the Military against exemption held by F. Stillingfleet (24, B 1), electrician at Underley Hall, near Kendal. Major Hope Brown, for the Military, contended that there was no need for an electrician at the Hall, but the estate agent replied that the man was in charge of the turbine for the electric lighting, and was a valuable man. The appeal was dismissed, and the exemption confirmed.

Dorset Appeal Court heard an appeal by the National Service Representative against temporary exemption until February 28th allowed to H. J. Barrow (36), electrical wireman with Messrs. Brooking & Co., electrical engineers, of Weymouth. Captain Chubb suggested that Barrow would be an excellent man for the engineers. The appeal was disallowed, and the exemption confirmed.

At Peterborough, exemption was claimed for F .Woodman (42, B 2), tramway traffic inspector, and E. A. Sewter (31, B 2), mechanic on the tramway maintenance and repairing staff. Each was allowed three months.

The Essex Appeal Court heard a Military appeal against exemption until March 1st allowed to G. A. Weston (38, B 1), electrical engineer, Westcliff, Southend-on-Sea. He has charge of the electrical fittings at hospitals and council schools, and the exemption was granted on the ground of domestic hardship and national interest. The appeal was refused, and the exemption confirmed.

On a National Service review, the Chippenham Tribunal has granted exemption until April 15th to F. Foyle (41, Class A), who is in charge of the electric plant at the cloth factory.

At Lewes, the Electric Supply Co., Ltd., appealed for renewed exemption for R. Woodward (27, general service), shift engineer, on the ground of certified occupation. Captain Selby Ash objected, as appellant had not attended the Volunteer drills. Woodward explained that the other assistant was away on Admiralty work. He was supposed to relieve him (applicant) at 6.30 p.m., but sometimes he had to wait until 8 p.m., and sometimes until 10.30 p.m. He had to remain until the other man came. He sometimes had to work 14 and 16 hours per day, and he had to work on alternate Sundays. The exemption was renewed until April 4th, appellant to join Section B of the Volunteers.

At St. Ives (Hunts), Messrs. Enderby & Co. appealed for S. J. Allen (B 1), engineer in charge of new electrical driving plant and machinery, and four months were conceded.

LEGAL.

Kensington & Knightsbridge Electric Lighting Co., Ltd., v. The Notting Hill Electric Co., Ltd.

THE hearing of this action was continued before Mr. Justice McCardie on Thursday. December 20th.

MR. TOMLIN, K.C., for the Notting Hill Co., detailed the findings of Mr. J. Swinburne, which were published in the ELECTRICAL REVIEW of October 12th, and concluded by submitting that the Arbitrator's award was wrong, and he had not correctly construed the agreements.

MR. VESEY KNOX, on behalf of the Kensington and Knightsbridge Electric Co., submitted that the award should be upheld. Counsel argued that the point taken by Mr. Tomlin with regard to the Kensal Town supply—viz., that it could not have been given unless it was given by the Metropolitan Co.—was not open to him, and that Mr. Tomlin was not entitled to put before the Court the statement of facts on which to found his argument. The maximum power taken last year by both the companies was less than half of the capacity of the joint station, and there had always been an enormous surplus of current. There never had been any question of limitation of output. Mr. Tomlin had claimed that the Notting Hill Co. had taken 600,000 watts, and had done all that they were required to do; but that was a misapprehension of the object of the relevant clauses, as these dealt with the limitation of the maximum demand. The clauses limited the amount which during a certain specified period could be taken from the joint station. The joint station had, at all relevant times, been ready and willing to give any supply required by the Notting Hill Co.

MR. JUSTICE MCCARDIE said that difficult matters were arising with regard to the facts found by the arbitrator. If they were to get on with the hearing, they must try to formulate some common basis of facts.

MR. TOMLIN said that the capacity of the joint station had been increased from time to time, and, instead of being limited to 1,800 KW., it was now 9,000 KW. His clients had, in regard to the total, always taken a fair proportion provided for in the agreements. There had been times when the station had not been in a position to give them all that they wanted.

The hearing of the case was continued on Friday, December 21st, and MR. TOMLIN, K.C., replied on behalf of the Notting Hill Co. He said the root question in the case was: What was the contract the Notting Hill Co. had entered into, and what had they contracted to do? If they had contracted to do something that was within their powers, and had not carried it out, they were liable in damages, but if it was not within their powers, they were not liable in damages because there was no contractual obligation of which there had been a breach, as they never had the contractual capacity to bind themselves by any such obligation. Upon the agreement there were two limitations—the supply was to be within the statutory area, and there was to be "a reasonable amount" taken. As the Kensal Town area was outside of the statutory area, if he was right, that concluded the whole point in his favour. Counsel also submitted that it could not be contended that as the arbitrator had found damages there was an end of the matter. The award had been framed in an alternative sense by Mr. Swinburne. The Kensington Co. could only found a claim on a breach by the Notting Hill Co. of a valid obligation, and they had to show that there was an obligation of which there was a breach, and in respect of which a claim for damages arose. There had been a supply to an area outside the statutory area which was *ultra vires*, and the Kensington Co. were now seeking to say that the Notting Hill Co. were bound to take the supply from the joint station "for any purpose"—even if it was illegal or *ultra vires*.

At the close of the arguments, as mentioned in our last issue, Mr. Justice McCardie reserved his judgment until the 1918 sittings.

BUSINESS NOTES.

Catalogues—Messrs. Vickers, Ltd., Electrical Sales Department, Vickers House, London, S.W. 1.—We recently mentioned a number of pamphlets which had been issued in foreign languages by this company as part of its foreign propaganda scheme. We have now received some further examples of this collection. One is a 60-page brochure produced in the same excellent style, containing a considerable number of finely executed half-tone views of the electrical machine shops of the company and typical examples of its electrical machinery manufactures, including A.C and C.C. generating plant, rotary converters and motor-generators, C.C. and A.C. motors, and motor-driven machinery. In all cases there is brief letter-press in several languages. A special Russian edition of this brochure is now in the press. Two little blotter slips, with illustrated backs, are printed in colour, about as artistically as anything of their kind that we have seen.

Calendars, &c.—Messrs. Peckham, Ducamp & Co., of 90, Charing Cross Road, W.C., have prepared a useful desk Reminder Book of very presentable appearance. Each page consists of a week's ample daily memoranda spaces, and will either turn over at the top or tear off.

From Messrs. Alex. Hawkins & Sons, of London Road, Southwark, S.E. 1, we have received an artistic wall calendar, small monthly date slips being fastened beneath a charming reproduction in colour of "The End of a Perfect Day."

The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, in accordance with their now long-established custom, have prepared a desk blotting pad, with the calendar for 1918 arranged in two halves on either side of the pad.

The Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, Cannon Street, London, E.C. 4.—Small hanging wall calendar with monthly slips for 1918.

From Messrs. Hill, Upton & Co., Ltd., of 22, George Street, Oxford, we have received a wall calendar with distinctly printed monthly slips, lighting times and moon changes being indicated in red ink.

The Sun Electrical Co., Ltd., of 118-120, Charing Cross Road, London, W.C. 2, have prepared a set of refills for their desk calendar for 1918. They will be pleased to send a set to any reader who has the metal base; unfortunately, as the circumstances of the time preclude the manufacturing of more metal bases at present, they are unable to forward complete calendars.

Once again we are indebted to the British Thomson-Houston Co., Ltd., of Rugby, for one of their large, businesslike wall sheet calendars. On each monthly sheet for 1918 there are printed, as before in smaller type, the dates for the preceding and the following months. A bird's-eye view of the Rugby works, and a half-tone illustration of plant made by the company, appear on each sheet, together with addresses of the B.T.H. branch offices.

Messrs. Taylor & Challen, Derwent Works and Foundry, Birmingham.—Wall calendar for 1918, with a set of perpetual changing date cards.

Messrs. Simplex Conduits Ltd., of Garrison Lane, Birmingham, have again sent us one of their useful pocket diaries, which not only admirably serves its main purpose, but also contains a quantity of engineering information and data. In addition we have received an ingenious ashtray, representing one-half of a Simplex four-way box, and an excellent leather pocket wallet, all of which items we highly appreciate.

Trade Announcements.—Messrs. Woolnough, Lang, Ltd., of Acton, have changed their name to Lang & Squire, Ltd., but the management of the firm is unaltered. Mr. Woolnough has had no interest in the company for some years. The company is now in a much stronger position to give prompt deliveries.

In connection with the death of Mr. Wm. Johnson, it is announced that the business of Messrs. Wm. Johnson & Co., electrical contractors, of 49, Leopold Street, Sheffield, will be continued under the management of Mr. H. J. Burdett.

Liquidations.—Resisto Electrical Manufacturing Co. Ltd.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. De Westley Layton, Thorner's Chambers, Ingram Court, Fenchurch Street, E.C. 3, by January 18th.

Book Notices.—"The Function and Place of Advertising in Modern Business Economics," with particular reference to the attitude of Government Departments to advertising. Issued by the Council of the Association of British Advertising Agents, London.

We have received copies of further issues of the B.E.A.M.A. *Journal*, printed in Spanish and Russian respectively. London: B.E.A.M.A., Oakley House, Bloomsbury Street, London, W.C. 2.

"Radio Communication Theory and Methods." By J. Mills. London: Hill Publishing Co. Price 7s. 4d. net.

"Central Stations." By T. Croft. London: Hill Publishing Co. Price 10s. 6d. net.

"Lighting Art." By M. Luckiesh. London: Hill Publishing Co. Price 10s. 6d. net.

"Circular of the Bureau of Standards." No. 68. Public Utility Service Standards of Quality and Safety. Washington: Government Printing Office. 5 cents.

The "Electrical Engineer's Diary," 1918. Edited by J. H. Johnson, M.I.E.E. London: S. Davis & Co. Price 6s.

Auction Sale.—Messrs. W. Houghton & Co. will sell by auction on January 30th, at the Mart, Tokenhouse Yard, various leasehold properties in Gt. Marlborough Street, and Foubert's Place, suitable for electrical engineers and manufacturers. See our advertisement pages to-day.

For Sale.—Leeds Corporation Electricity Department is inviting offers for a quantity of surplus plant, including engines, alternators, and condensing plant. For full particulars see our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Alton.—Prov. Order.—The U.D.C. has decided to oppose the application of the Aldershot Gas, Water, and District Lighting Co. for a prov. order for electric supply to parishes in the area of the R.D.C., in view of the fact that the Council before the war gave instructions for an electrical scheme to be prepared for Alton and adjoining rural parishes, and had postponed the scheme on account of the war.

Australia.—Uralla (N.S.W.) Municipal Council has applied for authority to carry out an electric light scheme. Armidale City Council has received a further offer to install electric lighting in the town from the Hellgrove and Armidale Water-Power Electric Co., which, under an old Act of Parliament, possesses legal authority to supply electricity in the district. The company proposes generating by water power at a site 10½ miles from the city.

The Lighting Committee of the South Grafton Municipal Council has recommended acceptance of the electric lighting proposal of Mr. J. N. Webber, of the Clarence River Timber Co.; under the scheme the Council will have the right to acquire the distributing system and battery to be erected, at such time as the Nymboida hydro-electric supply is an accomplished fact.

The city electrical engineer at Goulburn, N.S.W., has reported favourably on the question of substituting electric for steam power at the water works pumping station.

A conference of a number of towns, convened by the Goulburn Chamber of Commerce, is urging the Government to proceed with the Burrinjuck hydro-electric scheme.

In the Railways Bill now before the Victorian Parliament, provision is made for the sale of electrical energy in bulk by the Railway Commissioners; strong objection is being taken to the measure by the Melbourne City Council, because it would be possible for the bulk-supply business of the Council, on the expiration of agreements, to be transferred to the Railway Commissioners, and thus injuriously affect the financial stability of the Council's undertaking; also because it would empower the Commissioners to supply electricity to the Board of Works pumping station, the Harbour Trust, the new post office, and the Government cold stores, which are at present supplied by the Council. The Railway Commissioners, it is argued, would have power to "pick and choose" their consumers, and would naturally take the largest and most profitable. It is therefore urged that the Bill be withdrawn and that a conference be held between the Railway Commissioners and the Electric Supply Committee of the City Council, with a view of introducing an amending Bill to the next session of Parliament.

Mr. H. Frew, civil engineer, Brisbane, recently laid before a special meeting of the Townsville Council, Queensland, a scheme for a septic tank generating septic gas and providing power for electric light. Mr. Frew laid two proposals before the meeting—one a full installation, which would cost £23,400, and a smaller scheme, costing £13,900 for installation.

Aylesbury.—The T.C. has undertaken to supply Mr. Jas. Putman, of Haydon Hill, at a cost of £270, Mr. Putman paying £200 towards the cost, and guaranteeing at least £15 a year for 10 years. Current is also to be supplied to the mill of Mr. E. P. Collier at ⅝d. per unit.

Ballyshannon.—An application from cottage tenants to the D.C. for the introduction of electric light in the dwellings, was met by the chairman (Mr. T. Gorman) with the remark that if a 10 years' guarantee were given no objection would be offered.

Belfast.—The recent strike at the power station was settled by the men agreeing to return to work on the understanding that it the Order of the Ministry of Munitions is extended to semi-skilled and unskilled men. the Corporation will act on it as from the date applying to skilled men. The electrical service was maintained by volunteer workers from Corporation departments.

Braintree.—PROPOSED E.L..—Both the Crittall Manufacturing Co., and the U.D.C., have given notice that they are applying for powers for electric lighting. It is estimated that the contest will cost the ratepayers £300, equal to an addition of 4d. to the local rates.

Branstone. — Tutbury R.D.C. has consented to the Burton-on-Trent T.C. erecting a high-tension overhead line for the supply of current to a new factory.

Cavan.—Mr. J. F. Tierney, C.E., has reported to the B. of G. on the purchase of plant for the proposed installation of electric lighting in the workhouse. estimating that over £300 had been saved by the transaction.

Dorking.—PRICE INCREASE.—The Electricity Co. has increased the price of current for lighting from the date of the next quarterly meter readings by a further 5 per cent., making a total advance on pre-war rates of 20 per cent.

Dudley.—PRICE INCREASE. — The Electric Lighting Committee, on the application of the Power Co., recommends the Council to agree to an increase in the price of electricity by 12½ per cent.

Gainsborough.—PROV. ORDER.—The U.D.C. has decided that it is expedient to oppose the application of Mr. Jas. Marshall, of Messrs. Marshall, Sons & Co., Ltd., for a prov. order.

Grantham.—PRICE REVISION.—The Urban Electric Supply Co. announces that from January 1st consumers supplied on the weekly payment system will be charged 2d. in the 1s. extra per week for the eight winter months, instead of 1d. as at present. and slot meter consumers will be charged 4d. in the 1s. extra. instead of 2d.

Greenock.—YEAR'S WORKING.—The annual report by Mr. F. H. Whysall, burgh electrical engineer, on the working of the Corporation electricity undertaking during 1916-17, shows that the total output sold amounted to over 21 million units, an increase of 11·3 per cent. on the previous year. Greenock took 16,874,344 units, Port Glasgow 2,988,262 units, and traction absorbed the remaining 1,263,035 units. The total income for the year was £96,843, while the gross profits amounted to £42,062, and, after meeting interest and sinking fund charges, and providing £5,000 for depreciation, there remained a net surplus of £10,831, as compared with £6,998 in the previous year. The average total works cost was ·616d. per unit, as against ·659d., although the average price of coal was 1s. per ton more than during 1915-16, the reduction being entirely due to economies in generation, as a result of careful tests to ascertain the best conditions of working in the boiler house and engine room. The total connected load was 27,279 KW., and the maximum load 7,783 KW. The load factor improved from 28·99 per cent. to 31·02 per cent., while an increase of ·01d. over last year was obtained in the average price received per unit for the whole supply. The two new 30,000-lb. boilers installed in December, 1916, and the new cooling tower of 310,000 gallons per hour capacity have enabled considerable economies in generation to be made. The refuse destroyed at the destructor amounted to 15,063 tons, wages costing 2s. 0¼d. per ton destroyed ; 1,064,135 units were generated by the steam raised, and the value of these at ·35d. per unit was £1,552.

During the past year the installation and hire department has sent out electric heating apparatus having a capacity totalling 393 KW. ; altogether 282 motors and other appliances, representing 466 KW., were installed by the department during the year. The capital account now amounts to £404,841, of which £96,857 has been repaid ; of the net surplus £7,781 has been added to the reserve fund, which now stands at £41,200, and £3,050 has been transferred to the burgh general assessment account.

Halifax.—PRICE INCREASE.—The Electricity Committee proposes to increase the charges for lighting and heating by 12½ per cent.

Haslingden.—PRICE REVISION.—The General Purposes Committee has had under consideration the price paid by the Corporation for electricity, and decided that the following amended scale of charges should come into operation on January 1st, viz. : — Lighting purposes, 5d. per unit ; heating and ordinary power consumers, a further increase of 10 per cent. on original scale price, making a total increase of 25 per cent. ; tramways, a flat rate of 1¾d. per unit, as and from April 1st, 1917. With regard to the increase in the price per unit to be charged to special power consumers under agreement, they had agreed to forego the terms set out in the respective agreements, and were prepared to pay an additional figure based on the Accrington Corporation's works costs.

Hebden Bridge.—The Council, in Committee, has decided to oppose the Yorkshire Electric Power Co.'s Bill.

High Wycombe.—STREET LIGHTING.—Subject to an approved agreement for street lighting, the T.C. has accepted the offer of the Electric Light and Power Co. to accept £500 instead of £600 in respect of street lighting for 1916, and the pending action at law has been stayed for one month by the company without prejudice.

Hull.—NEW PLANT.—On Saturday last the Lord Mayor officially started a new 5,000-KW. Dick, Kerr turbo-alternator at the Corporation electricity works. The turbine is of the impulse type, running at 1,500 R.P.M. and exhausting into a surface condenser ; it is coupled to a 6,600-volt, three-phase alternator, with an overload capacity of 25 per cent. for two hours and 50 per cent. for five minutes. Two large water-tube boilers have been added in the boiler house, equipped with inclined grate mechanical stokers designed to burn 2 tons and 30 cwt. of low-grade slack respectively per hour. An electro-hydraulic coal tipper and telpher grab have been installed in connection with the overhead bunkers.

Kingston-on-Thames.—The Electricity Committee has received a reply from Edmundson's Electricity Corporation, stating that while the company is not prepared to alter the essential terms of the offer, if the Committee would indicate in what respect it considered the offer not acceptable, the company would carefully consider any suggestions which might be put forward.

The Committee has informed the Council that it was such essential terms that were unacceptable, so that if the company desired to reopen the matter it was for it to make proposals more satisfactory in essentials.

Leeds.—LINKING-UP.—The Ministry of Munitions has recommended the consideration of a linking-up scheme in connection with the Leeds and Bradford electricity undertakings, and the subject is now being considered by the officials concerned. The application from the Corporation for consent to the carrying out of the scheme of electricity extensions has been refused by the Ministry, but authorisation has been granted for a 6,000-KW. plant, at an estimated cost of about £35,000. The Electricity Committee has conditionally accepted a tender for the work from Messrs. Richardsons, Westgarth & Co., at £29,790, and sanction to the tender is being awaited from the City Council.

Leek.—PROPOSED LOAN.—The U.D.C. has decided to make application to the L.G.B. for sanction to borrow £1,250 to provide additional plant for the electricity works, the Ministry of Munitions having consented to issue a certificate for it.

Leyton.—PRICE INCREASE.—The U.D.C. has decided to advance the price of electricity for light and power from the commencement of the Lady Day quarter by 13⅓ per cent., making a total increase since the war of 33⅓ per cent. The charge to the tramways department is to be further advanced by 5 per cent., making a total of 10 per cent.

Llandudno.—The Council has received a report from Mr. Patchell on the supply by the Council of electrical energy to the Llandudno and Colwyn Bay Electric Railway. Mr. Patchell decided that the traction business had not yet been done at a loss, although the margin of profit had almost disappeared : an increase in the price of energy supplied for traction and lighting was desirable, particularly as the top price might not yet have been reached in fuel. The Council might give the Electric Railway Co. notice to terminate the arrangement for the supply of current for traction purposes, or it might accept the company's offer of increased rates in consideration of a modified form of Sunday running. Before giving notice to the company of discontinuance of traction supply in 12 months' time, the E.C. was authorised to re-open negotiations, and to report at the next meeting.

London.—HAMPSTEAD.—The Council has decided to abolish the maximum demand system of charging for electricity, and six months' notice is to be given to those consumers of electricity now charged upon that system to terminate their agreements at midsummer, 1918.

Morecambe.—PRICE INCREASE.—From March 31st the price of electricity will be 3½d. instead of 3d. per unit for power, and 6½d. instead of 6d. for lighting, with a minimum charge of 10s. 10d. per quarter on all lighting consumers and of 5s. 10d. per quarter on power consumers.

Newport (Mon.).—PRICE INCREASE.—The Electricity and Tramways Committee has recommended a further increase of 15 per cent. on all electricity charges excepting bulk supply contracts. It has also decided to cancel until further notice the two-rate meter scale, as it was found that a very large number of smaller consumers were taking advantage of the scale to obtain their supply at exceptionally low rates.

The electrical engineer reported to the Committee that serious delay had occurred in the delivery of extension plant at the East power station ; the matter is to be taken up with the Ministry of Munitions.

New Zealand.—In the Government Public Works statement authority is proposed to be taken for the raising of £136,000 for the development of water power.—*Tenders.*

Northampton.—PRICE INCREASE.—The Electric Light and Power Co. announces a further increase in the price of power of 10 per cent. as from the Christmas meter readings.

Norwich.—PRICE INCREASE.—The City Council has decided to make an addition of 5 per cent. to the charges for electricity for lighting and heating and 10 per cent. for power as from the reading of the meters for the Christmas quarter, 1917.

Stalybridge.—PRICE REVISION.—The Joint Board has decided that the following alterations be made in the charges for electricity as from January 1st,: — Lighting, 4½d. per unit, less 5 per cent. ; mill and factory lighting, 3d. per unit net ; heating supplies, 1¼d. per unit net ; theatre and cinema tariff, plus ½d. per unit ; cotton mill power supplies, 5 per cent. on standard scale,

Stockport.—The electrical engineer reported that he had offered to fix lamps on the tramway overhead equipment in the Cheadle and Gatley district at £3 each, and to maintain and light the same at a further cost of £3 per lamp. The Cheadle Council considers the charges too high, and asks for a reconsideration of the same.

United States.—To assure an adequate supply of electric power for factories the Government has requisitioned the electric power produced, imported, and distributed by the Niagara Falls Power Co., the Hydraulic Power Co. of Niagara Falls, and the Cliff Electric Distribution Co. There had been some adjustment to war industries before, but the new order will intensify the arrangement.—*Daily Chronicle.*

TRAMWAY AND RAILWAY NOTES.

Australia.—The Melbourne Tramways Board Bill extending the term of the present Board until October 31st, 1918, has passed the third reading in the Victorian Legislative Assembly.

The report of the N.S.W. Railway Commissioners for the September quarter on the working of the Government tramways, is particularly interesting, as it shows the effect of the strike. The gross earnings were £346,539 as against £482,337, a decrease of £135,798; working expenses amounted to £314,030, as against in 1917 £394,030, a decrease of £80,015; and the net revenue was £32,500 as against £88,292, a decrease of £55,792. The car-miles run were 3,809,354 as against 6,463,650, a decrease of 2,654,305, and the passengers carried 48,308,318 as against 71,714,876.—*Sydney Daily Telegraph.*

Blackburn.—Traffic Figures.—During the 276 days running in the year 1917-18 up to and including Boxing Day, the receipts on the tramways amounted to £58,880, an increase of £9,546 on the takings for the same period a year ago.

Bradford.—The Christmas holiday tramway receipts show a four-days' total £1,026 in excess of those of 1916.

Owing to some abuse of the privilege, the free travelling tokens granted to soldiers at the local recruiting offices have been withdrawn.

Halifax.—Revised Fares.—It is understood that tramway fares are about to be advanced by 50 per cent., and that transfers are to be abolished, and various other modifications of the service introduced, owing to the difficulties of the times.

Accident.—A serious runaway tramway accident occurred last Friday, resulting in the death of a cart driver from injuries and the electrocution of one of his horses. The rails were greasy, and the car got out of control whilst descending a hill, and crashed into the back of a coal cart; the car subsequently collided with a switch-box fixed to one of the tramway standards, and when the box was smashed and the cables fused the shaft horse was killed by electric shock. The car left the rails, but remained upright, and nobody on board was hurt

Wages.—The War Wages Committee has declined the recent applications by the Amalgamated Association of Tramway Workers for increased wages. The Committee has also submitted the following resolution for the approval of the T.C.:—"That the Halifax Corporation view with alarm the continual applications for increases of wages and war bonus from the employés engaged by Corporations and other public bodies, seeing that the rates of increase of wages already given are, in the opinion of this Corporation, in excess of the actual increased cost of living, while continual accretion of the wages bill is tending to produce unrest in other sections of the community. Further increases will compel Corporations to have recourse to State assistance, and this Corporation urge the Government to give the matter their earnest consideration, and at the same time to give instructions to the Committee on Production that, in deciding any future applications, the Committee must fix a time limit within which no further applications should be considered; and, further, that a copy of this resolution should be forwarded to the Prime Minister, the Chancellor of the Exchequer, the President of the L.G.B., the local Members of Parliament, and also to the various County Borough Councils in the West Riding, asking such Councils to pass a similar resolution, and forward the same to the above-mentioned Government Departments and to their local Members of Parliament."

Lancashire.—Despite the unpopularity of their action and the serious inconvenience caused to the public, the tramway employés of Manchester, Salford, Rochdale, Burnley, and other towns in Lancashire refused to work on Christmas Day.

Leeds.—Parcels Service.—At a meeting of the Tramway Traffic Sub-Committee, it was reported that a Committee had been formed in connection with the use of the tramways for the distribution of parcels in the suburbs, and a number of representative tradesmen have been invited to join it, with a view to restricting the use of motor-cars and horse vehicles owing to probable further drastic reductions in petrol supplies and feeding stuffs. A scheme has been formulated, and this is awaiting the approval of the B. of T.

Mansfield.—The T.C. has asked the Light Railway Co. to pay an increased price for energy supplied.

Tramway Wages.—Applications are to be made on behalf of tramway employés of 19 authorities in Lancashire and Cheshire for a further advance in wages of 10s. per week.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—A wireless station has been set up at Plomer, in the Argentine Republic, under the supervision of the firm of Siemens-Schuckert. It has a range of 15,000 km., and thus can communicate with Nauen, near Berlin. Trial messages transmitted from Germany were received at the Plomer station, although not sufficiently clearly to be intelligible, owing to the intense atmospheric phenomena.—*Industria e Invenciones.*

Australia.—The telephone service shows a profit of £18,000, as compared with a loss of £270,000 during the previous year.—*The Times.*

Continental.—Denmark.—The Valdemar Poulsenske Syndekat has taken over the Aktie-Selskab Dansk Telefonfabrik, and will now exclusively make the smaller wireless installations for ships. The company is stated to have already a large number of orders in hand, for delivery immediately on the cessation of hostilities.—*Teknisk Tidsskrift.*

Japan.—H.M. Commercial Attaché at Yokohama writes that the Japanese Department of Communications wishes to establish in future a large new wireless station, which will develop the same transmission power as that at Funabashi, which is the largest plant in Japan. Wireless communication between Japan and Hawaii and the United States is steadily increasing, but at present the Funabashi station is the only one that is open to public use. The Funabashi plant, however, belongs to the Japanese Navy, and it is reported that the Department of Communications is desirous of establishing a new station exclusively for the benefit of the general public, at an estimated cost of about £71,500. It is also reported in this connection that the Department has decided to erect a wireless station in the Ojika Peninsula, Akita Prefecture.

The only important concern making wireless apparatus in Japan appears to be a company at Tokio, which is said to be very busy at present constructing wireless sets for the large number of ships now being built in Japan. The company is a fairly new one, with a capital of £25,000, of which half is paid up. The apparatus which it manufactures is known as the "Japanese system," and is said to be a combination of various European and American inventions.—*B. of T. Journal.*

The Pacific Cable.—The report of the Pacific Cable Board for the year ended March 31st, 1917, shows that the receipts were £336,774, the expenditure £155,848, and the surplus, after placing £90,000 to the renewal fund, was £90,926. Of this sum £77,545 was paid in respect of interest and sinking fund, and £9,150 to the renewal fund for the New Zealand cables, leaving a net balance of £4,231. In the previous year the contribution to the renewal fund was £30,000, and this year a special contribution of £10,000 has been made to the provident fund, to meet the depreciation of securities. The surplus will be applied to the reduction of debt. The traffic receipts increased by £26,127, and the expenses by £13,951. The renewal fund investments at March 31st were valued at £291,067, with cash in hand £73,829, and cable valued at £65,293.

Throughout the year the cables suffered no interruption and required no repairs; the long sections were working at full load day and night during the whole year. The landlines also have worked well. Electric lighting and power plant is being installed at the Suva station in place of the existing acetylene gas plant. Sir Wm. H. Mercer retired from the Board, and was succeeded by Mr. H. C. M. Lambert. The special war allowance to the staff has been increased to 20 per cent. of net salary for the year 1917; and as most of the members were entitled to extended leave, which, under war conditions, could not be taken, leave rights have been commuted to the value of £3,500.

During the year nearly nine million paying words of international traffic were transmitted by the Pacific Cable, as well as 650,000 words relating to wounded members of the Field Forces gratis; the traffic exceeded that of the previous year by 1¼ million words, and has practically reached the limit of capacity with existing types of apparatus. The Board also carried 1,795,200 paying words between Australia and New Zealand and the Pacific Isles. At times of congestion it has been found necessary to suspend certain services, or to transfer a portion of the traffic to the Eastern Co. The week-end telegram service has been suspended since July, 1916, in the outward direction, and since November, 1916, in both directions. The outward deferred Press service has been suspended since August, 1916, and the deferred ordinary service on outward traffic since June, 1917, but it is hoped that the latter may be restored in the near future.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-kw. turbo-alternator with condensing plant. See Official Notices" December 7th.

Keighley.—January 9th. Electricity Department. Induced draught plant. See "Official Notices" December 21st.

Manchester.—January 16th. Electricity Committee. Rotary converter or motor converter plant. See "Official Notices" December 28th.

February 2nd. Waterworks department. Electrically-driven radial arm crane. See "Official Notices" to-day.

Tipperary.—January 11th. New battery for the Union electric lighting plant. See "Official Notices" December 21st.

CLOSED.

Australian Contracts.—Mr. H. R. Harper, city electrical engineer, Melbourne, has sent us the following information regarding recent tenders for electrical plant:—In November, 1916, the Council advertised for tenders for a 7,500-K.V.A. turbo-alternator, returnable March, 1917. When tenders came to hand, however, it was decided to postpone consideration of them, in view of the decision of the Government to consider the inauguration of a State supply of electricity in bulk, generated on one of the brown coal fields for which Victoria is noted.

The tender for a 2,000-KW. rotary converter put forward by the Australian General Electric Co., for a set made by the General Electric Co., U.S.A., at £6,601, f.o.b., was accepted. In view of the impossibility of obtaining any plant from British manufacturers until after the war, the order was placed with an American firm, as it was essential that this plant should be in operation for next winter.

With the object of carrying out tests with inferior coals, the Council, in May, 1916, placed an order with the Erith Engineering Co., London, for two Erith Riley stokers complete with fans and hydraulic controls. The Erith Co., however, were unable to obtain a priority certificate for the manufacture of these stokers, and as the Sanford Riley Co., U.S.A., were able to guarantee delivery within a reasonable period, the order has recently been transferred to the American company.

MELBOURNE.—Electricity Committee. Accepted tenders:—

1,000 500-watt gas-filled metallic filament lamps, £850.—Australian General Electric Co.
Two 3-phase, 100-K.V.A. transformers, £239. Sutherland & Ashman.
200 lanterns for gas filled lamps, £668.—R. Bryce & Co Pty., Ltd.

SYDNEY.—Metropolitan Board of Water Supply and Sewerage. Electrically-driven air compressors for the N. Sydney Works. Ingersoll Rand Co., £6,291.

Electric Lighting Committee. Tenders recommended:—

Australian General Electric Co.—3,000 5-amp., A.C. meters, £4,050; 1,500 10-amp. do., £1,362 10s.; 200 25-amp. do., £295; 40 50-amp. do., £89 10s. and spare parts (£100), making the total tender price £5,987. These prices do not include ocean freight or insurance, estimated at £460, which will be paid by the Council.—*Tenders.*

Victorian Railway Department. Tenders accepted:—

Bare H.D. 17/18 S.W.G. copper cable, 2s. 10d. per lb.; rubber-insulated E.L. cable, 7/18 S.W.G., £63 10s. per mile; 7/20 S.W.G., £41 per mile.—W. T. Henley's Telegraph Works Co., Ltd.—*Tenders.*

TASMANIA.—LAUNCESTON. City Council. Accepted tenders:—

8,651 metal filament lamps, £ 60.—Edison Swan Electric Co., Ltd.
3,200 ,, ,, ,, £243.—Australian General Electric Co.
7,250 ,, ,, ,, £553.—Aust. General Electric Co.—*Tenders.*

Barnes.—U.D.C. Cable: Pirelli-General Cable Works, Limited.

Brighton.—B.G. Electrical fittings: Mr. H. J. Galliers, Brighton, £43.

Bradford.—Guardians. Contract with Waygood-Otis, Ltd., for maintenance of lifts, continued at increased charge of 20 per cent.

Derby. The T.C. has accepted the following tenders for the electricity and tramway departments:—

Babcox & Wilcox, Ltd.—Boiler, £4,500.
C. A. Parsons, Ltd.—4,000-KW. turbo-alternator, £24,000.
T. W. Brackett & Co., Ltd.—Water screen, £355.
Firth, Blakeley, Sons & Co., Ltd.—Chimney, £230.
Holmes Bros., Ltd.—Tramcar wheel tires, £53.

Hull.—T.C. Extra-high-tension switchgear: British Westinghouse Co., Ltd., £1,284.

Ilford.—U.D.C. 1,000 tons of nutty slack coal for the electricity works: Messrs. Blackman & Co., £1 1s. 11d. per ton.

Lancaster.—T.C. Boiler repairs and electric welding at the electricity works: J. L. Gordon, Liverpool, £35.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, January 5th. At 3 p.m. At Albemarle Street, Piccadilly, W. 1. Christmas Lectures, "Our Useful Servants: Magnetism and Electricity": (Lecture V) "Electric Dynamos, Motors, Transformers and Railways." Tuesday, January 8th, (Lecture VI) "Electric Telegraphs and Telephones."

Institution of Civil Engineers.—Tuesday, January 8th. At 5.30 p.m. At Gt. George Street, S. W. Papers on "Rail Creep," by Mr. F. Reaves, and "Creep of Rails," by Mr. H. P. Miles.

Liverpool Engineering Society.—Wednesday, January 9th. At 8 p.m. At the Royal Institution. Paper on "Refrigerator Installation for Carriage of Ships' Provisions," by Mr. J. B. Wilkie.

Association of Engineers-in-Charge.—Wednesday, January 9th. At 8 p.m. At St Bride's Institute, Ludgate Circus, E.C. Paper on "The Human Factor in Modern Production."

Institution of Electrical Engineers.—Thursday, January 10th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Electrical Signalling and Control on Railways," by Mr. C. M. Jacobs.

(**Scottish Local Section**).—Tuesday, January 8th. At 7 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Gillott.

Greenock Electrical Society.—Thursday, January 10th. At 7.45 p.m. At 22, West Stewart Street. Paper on "Small Private Plants," by Mr. G. T. Morrison.

Electro-Harmonic Society.—Friday, January 11th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber), Smoking concert.

London Association of Foremen Engineers. Saturday, January 12th. At 7 p.m. At Cannon Street Hotel, E.C. Presidential address by Mr. R. M. Campbell.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 12th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Cable Complaints," by Mr. J. H. C. Brooking.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the ELECTRICAL REVIEW, which will be printed in the course of a few days, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Electro-Harmonic Society.—The next Smoking Concert will be held at the Holborn Restaurant, in the Venetian Chamber, on Friday, January 11th, at 8 p.m. The artistes will be as follows:—Mr. Anderson Nicol, tenor; Mr. Harry Morton, concertina; Mr. Ben Lawes, humorist; Mr. Arthur Backner, musical monologues ("Rubinstein at the Piano"); Mr. Robert Pitt (baritone), and Mr. Langton Marks (humorist and pianist), in ragtime duets and humorous "Business" at the piano; Mr. Bernard Flanders, A.R.A.M., sole pianoforte and accompanist.

Destruction of a German Power Station.—The *Times* states that by the explosion at an explosives factory at Kirchbaumvasen, near Karlsruhe, last week, a large new electrical station, furnishing power to the Imperial Nitric Acid Works, was completely destroyed.

The Wages of Central-Station Employes.—Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A., recently circulated to the engineer members of the Association a memorandum relating to wages and awards.

The memorandum states that the awards of the Committee on Production are only binding upon the parties to an agreement which was come to between the Engineering Employers' Federation and certain Trade Unions, except that they have also been made applicable by an extending Order issued by the Ministry of Munitions to certain undertakings. Those members who have not been advised that their department is one of the undertakings to which the extending Order applies, are not bound by the awards of the Committee on Production.

At a meeting held at the Ministry of Munitions on December 10th, when the I.M.E.A. was represented by Mr. Beauchamp and Mr. Proctor, it was explained that the 12½ per cent. award, and also the awards of the Committee on Production, did not, broadly speaking, apply to such undertakings, although they might be certified undertakings under the Munitions of War (Amendment) Act, and it appears desirable whilst such conditions exist that any advances granted should be made on purely local grounds. If any particular awards are followed a precedent may be formed, and in the event of other awards being made compulsory upon electricity undertakings, the one series of awards might be super-imposed on the other awards, although such was not the intention.

The 12½ per cent. is to apply only to men in the engineering trade and moulders. Referring to tramway and electric supply undertakings, it was stated that where undertakings had repair shops, the repair shop would come under the "engineering trade," but the remainder of the works, such as the generating station, was not "engineering trade." The award does not, therefore, appear to be absolutely compulsory outside the repair shops, unless a precedent has been or is created.

Standardisation of Tramway Overhead Construction.—A sub-committee of the Municipal Tramway Association upon the question of "Standardisation of Overhead Construction" has held a meeting at Leeds. The work of this Committee is of a very far-reaching and important nature, dealing as it does with the standardisation and drawing up of the specifications for every overhead fitting used in tramway work, including trolley wires and trolley wheels. The object to be attained is to standardise everything possible, so that after the war tramway undertakings will be able to get good deliveries and reasonable prices due to the fact that manufacturers will not have to keep such large stocks. At the present time there are as many as 50 to 100 different forms and types of one fitting—each engineer having his own ideas and the manufacturers having to hold a stock of each. The work will occupy a considerable time and will necessitate collaborating with the American Tramway Standardisation Department and with the British Engineering Standards Committee.

The Coal Conservation Sub-Committee's Report.—As might be expected under the circumstances, the electric supply proposals involved in the above report have called forth considerable comment in different parts of the country.

Ald. Pearson (Bristol), hon. solicitor to the I.M.E.A., pointed out that that body had never opposed a scheme for improving the electrical supply of the country. He regretted that the Coal Conservation Committee, on which there was no municipal representative, had issued a report which they might reasonably expect to have received from the Board of Trade Committee on Electrical Power Supply now sitting; also that it favoured company as against municipal working at a time when this matter was being considered by the latter Committee, and particularly that the operations of one company are dealt with, as proving, in some degree, the correctness of the opinions set forth in the report. Cheap electricity was necessary to progress, and cheap money was essential to success; the latter could more easily be obtained by a municipality than a company, and still more easily by the Government.

Mr. H. Faraday Proctor (Bristol), hon. sec., I.M.E.A., agreed with most of the proposals, but took exception to comparisons of municipal and company working in favour of the latter. The question was, however, one for the B. of T. Committee now sitting. He welcomed the idea of larger areas.

Mr. S. L. Pearce (Manchester) interviewed on the subject, mentioned that the Lancashire and Cheshire authorities already had a scheme for their area very much on the lines suggested in the report; this would require the approval of the B. of T. and it might be that the larger scheme would absorb the local one, but until the B. of T. Committee considered the whole matter it was difficult to forecast the result.

[It is worth noting here that at a recent conference of 31 authorities of Lancashire and Cheshire interested in the local scheme. the linking-up proposals were agreed in principle, but the second portion of the proposals, relating to the constitution of one financial authority to take over the responsibility of the existing undertakings, was rejected by 21 votes to 10.]

Mr. Harrison Barrow (Birmingham), discussing the report, objected to the favouritism being shown to private enterprise because "it seemed to be an attempt at reaction from municipal to capitalistic control." The proposals would result in a great monopoly, and the company directors would apparently have entire control subject to some rather nebulous National Commission. He entirely agreed that the present municipal areas of electricity supply were unsatisfactory.

Mr. S. E. Fedden (Sheffield). at an interview, admired the scheme on paper and from the point of view of coal saving, but doubted whether it would give Sheffield cheaper electricity. The North-East Coast power scheme was not a fair criterion on which to base judgment for the entire country. The majority of the big industrial centres, like Manchester, Birmingham, and Sheffield, were not touched by tidal waters, and in such places cooling towers would have to be erected. Distant stations would involve tremendous transmission difficulties unless the Government acquired the land compulsorily. The existing vested interests would be another huge obstacle. For Sheffield he thought the project was outside the realms of practicability for the present, and it would be suicidal for them to delay their present scheme for a plan which was but in the theoretical stage. Their new power station would give them over 100,000 KW., making, with the existing plant, a total of 168,000 KW.

Mr. W. A. Chamen (South Wales E P S. Co.) interviewed on the question, said there was no doubt that, if worked to the best advantage, the requirements of Cardiff, Newport, and those of his company could be best supplied from one large station; the three engineers, in these cases, were agreed on this in principle. [Mr. Nichols Moore (Newport) has, however, since pointed out that this was only agreed as one of three possible solutions.] One large power station would also supply Swansea, Neath and Llanelly more economically. He had no knowledge of much waste heat in South Wales, as the collieries used it themselves, but there was an opportunity of putting down by-product plant in connection with superstations. The question of the method of applying the scheme rested with the B. of T. He added that the South Wales Linking-up Committee would issue its report shortly.

Mr. R. P. Sloan (Newcastle E.S. Co.), interviewed on the report, mentioned that the North-East Coast power companies had on order some 27,000-H.P. generating sets, which would be installed on a site on the River Tees, where accommodation would be provided for a large coal carbonisation plant. The Newcastle Co. had for some time been experimenting on low-temperature coal carbonisation, and lately on a fairly large scale, and they hoped to effect large economies.

Concerning the control of electrical undertakings by a Board of Commissioners, Mr. Sloan thought that if the Board acted in a judicial rather than executive capacity it would be beneficial to the supply industry. In his opinion, the problem of supplying electricity throughout a large area was totally different to that of supplying large towns; the North-East Coast power companies, and possibly one or two other power companies, were the only undertakings which had the necessary experience to any great extent. The generating and supply of electricity should be under one control, whether municipal or company.

Both Mr. Sloan and Mr. Starr (of the Clyde Valley Power Co.) disagree with certain statements made by Mr. Lackie (Glasgow) defining the position of municipal undertakings in regard to cheap electricity supply.

Mr. Lackie considered that the progressive reduction in the cost of electrical energy must be increasingly in favour of municipalities on account of the manner in which the latter were compelled to repay borrowed capital.

The Ministry of Munitions and Restrictions on Cable Laying.—Correspondence has passed between Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A., and the Director of Electric Power Supply regarding a communication, dated December 8th, relating to the use of cables for the connection of additional consumers.

The letter from the Ministry of Munitions states that until further notice the Ministry of Munitions will raise no objection to additional connections being made to supply mains, subject to compliance with the following conditions:—

1. That adequate generating plant capacity is available.
2. That no lead-covered cable is used on the connection.
3. That the cost of the connection (including any mains extensions) to be borne either by the undertaking or by the consumer does not exceed £10.
4. That the manager forwards to the Director of Electric Power Supply at the end of each month a list of consumers connected during the month, giving name, address, purpose, kilowatts installed, and cost of connection.

It is not desirable to connect new consumers who already have alternative methods of obtaining light, heat, or power, or business premises not used for direct or indirect war work. No connection, the cost of which will exceed £10, or in which lead-covered cable is required, may be made until the sanction of the Department has been obtained.

In reply to an inquiry from Mr. Proctor, a further letter states that it is desirable that existing stocks of lead-covered cable should be husbanded as carefully as possible. Lead-covered cable should not, therefore, be used for making house connections, except in accordance with the directions set out above.

In reply to Mr. H. A. Howie, manager of the Walsall Corporation electric supply department, the Director of Electric Power Supply said that even in the case of direct war work accompanied by a certificate, no connection the cost of which exceeded £10 should be made without the sanction of the Department. A certificate for any expenditure must be applied for, and be granted direct to the manager. No new cable could be purchased without a permit, and when it was necessary to order additional cable, an application should be made stating the length, type, and cost of the cable required.

On December 22nd Mr. Proctor wrote to the Director as follows:—

"With further reference to your letter of December 8th, I have been requested by sundry of our members to ask you to give your kind consideration to the suggestion that the £10 limit which you impose as the maximum to be expended on the cost of connecting a consumer should apply only to the cost of the cable alone, or, at the worst, to the cost of all material, cable, duct, boxes, &c.—that is to say, excluding the cost of all labour, supervision, and establishment charges from such £10 limit, for the reason that work carried out under the conditions you mention will no doubt in every undertaking be carried out by the regular maintenance staff – that is to say, no further call upon the labour market would be made in the execution of such work. I trust that you can see your way to agree to this."

In reply, the Director of Electric Power Supply said:—"I am directed to acknowledge receipt of your letter of the 22nd inst., and in reply thereto am to say that the £10 limit does not necessarily prevent the connection of a consumer, but it necessitates an application to this Department for sanction. In every case where the limit exceeds £10 and electrical undertakers consider the circumstances justify their submitting an application to me for decision, the same will always receive every consideration. In the meantime, however, I am willing that the £10 shall exclude labour, so long as no outside labour is employed, and you may advise your members to this effect. It was not intended that the limit should include supervision and establishment charges."

The following is a copy of a resolution passed by the Harrogate Electricity Committee on December 31st, 1917:—

"That the Committee protest against the arbitrary interference with the conduct of the local electricity supply as set forth in the communication from the Ministry of Munitions of December 8th last and interpreted by the subsequent correspondence. Economy in the use of lead for new cables may be desirable, but the use of lead-covered cable already in the local stores might reasonably be left to the discretion of local undertakers. The monthly return of business asked for entails considerable extra work, and in view of the imperative call for man-power for the direct prosecution of the war, it is difficult to appreciate either the need for such data or how a staff can be found in a Government Department to give time and attention to such comparatively minor and unimportant details."

Prize Awards.—The Academie des Sciences has awarded the Gaston Planté Prize to M. Henri Armagnat for his experimental researches in electricity. The Hughes prize has been awarded to M. Amédée Guillet for physics, especially a study of damped vibrations.

The Royal Dublin Society's Boyle Medal has been awarded to Prof. J. A. McClelland, Sc.D., F.R.S., for research in many branches of science, but primarily in those which deal with ionisation as resulting from additions of electrons to gaseous molecules, or aggregates of such, and the more recently discovered forms of radiation associated pre-eminently with radio-activity.

Volunteer Notes.—County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending January 12th, 1918, by Lieut.-Colonel C. B. Clay, V.D., commanding.

Officer for the Week. Lieut. W. J. A. Watkins.

Next for Duty.—Second Lieut. H. G. Golding.

Monday, January 7th.—No. 3 Company, 6.30—8.30. Recruits' drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 8th. Lecture on "Demolitions" at 6.30. Physical drill, 7.30.

Wednesday, January 9th. No. 1 Company, entrenching, &c., at 6.30. Recruits' drill, 6.30.

Thursday, January 10th. No. 2 Company, entrenching, &c., at 6.0. Recruits, 6.30. Signalling Section at 6.30—8.30. Ambulance Section at 6.30—8.30. Medical examination of recruits at 6.30.

Friday, January 11th.—Musketry, 5.30—8.

Saturday, January 12th.—Knotting, lashing and splicing at 2.45. Musketry, 2.45—4.45.

All drills will be at Headquarters unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

"The Rarer Key Minerals."—The following letter came to hand after our "Correspondence" columns had been closed:—

"In your issue of December 28th last a letter appears from the British Thomson-Houston Co. commenting on a report of my recent lecture upon the above subject, and stating that I was misinformed regarding the production of ductile tungsten filaments in this country before the war. This is not the case, however, as the statement made at the lecture was to the effect that before the war ductile tungsten filaments were not being produced on a commercial scale in this country *from the ore*. This fact is substantiated by the details in the letter from the B.T.H. Co.

"The *final* stages in the manufacture of the filaments were certainly carried out in this country before the war, but, so far as I could ascertain, no firm was at that time manufacturing ductile tungsten filaments from tungsten ore. The imported manufactured products which were, at that time, used by the various firms *as the starting point*, were pure tungstic oxide or tungsten rod.

"It would appear from their own statement that the B.T.H. Co. had to devote at least a year to investigation before they could bridge the gap between tungsten ore and their previous starting point, *i.e.*, pure tungstic oxide.

"Sydney J. Johnstone.

"New Barnet, *January* 1st, 1918."

Scottish Linking-up Proposals.—The West of Scotland Committee, dealing with this matter, has issued its conclusions; it proposes to divide into four electrical groups an area which includes the counties of Renfrew, Clackmannan, Linlithgow, and portions of the counties of Ayr, Lanark, Dumbarton, and Stirling. One of these groups comprises the Glasgow Corporation area and that of the Clyde Valley Power Co.; the linking-up of the Glasgow group would cost about £16,000, and the estimated saving thereby is put at £10,000 a year.

Institution and Lecture Notes.—The Röntgen Society.—At the meeting of the Röntgen Society on December 19th, Prof. J. W. Nicholson, F.R.S., read a paper in which he described some recent work by M. de Broglie, of Paris, with regard to the discovery of absorption spectra of X-rays. The rays after being generated are separated off into a spectrum by a crystal which acts as a diffraction grating, and the spectrum of the radiation is recorded on a photographic plate. Into the path of the radiation various elements, usually in the form of very thin sheets of metal or sheets of paper painted over with compounds, are interposed which are capable of absorbing the rays to a varying extent, and thus the spectrum of the particular metal or other interposed substance is obtained. Prof. Nicholson showed lantern slides of very many of these absorption spectra, and said that the general result was to establish the essential identity of X-rays and ordinary light in every respect except in the order of magnitude of the wave length. In this respect there was a complete difference: the spectroscopic investigations had again proved the extreme smallness of the wave length of X-rays, which was practically of the same magnitude as the radius of an atom. One remarkable example shown was the X-ray spectrum of tungsten and of certain other components, and in this instance the positions of the various lines were as marked as in the ordinary spectrum of visible light, which indeed it very much resembled. At the same meeting Mr. Charles A. Schunck, F.C.S., read a paper on "The Region of the Ultra-violet Spectrum of Greatest Therapeutical Effect." As a result of working with carbons, metallic tungsten, and the mercury-vapour lamp, and judging the therapeutical effectiveness by the production of an erythema reaction, Mr. Schunck came to the conclusion that the region of greatest effect was among the very shortest wave lengths, from 2,540 to 2,380. Dr. Sydney Russ, however, combated this view, and thought that too much attention had been paid to these very short wave lengths, and that the very active germicidal region between wave lengths 2,960 and 2,880 had been overlooked.

Electrical Association of Australia (Victorian Section).—On November 1st, at Melbourne, Mr. Victor Nightingall read a paper, illustrated by experiments, on "The Possibilities of the Luminescent Lamp by the Discharge of Electrons in High Vacua."

Institution of Civil Engineers.—On Wednesday the Institution of Civil Engineers completed the hundredth year of its existence, having been established in 1818 at a meeting of eight engineers at the Kendal Coffee House in Fleet Street.

At the next ordinary meeting of the Institution on Tuesday, January 8th, before the discussion of papers, a statement commemorative of the founding of the Institution on January 2nd, 1818, will be made, present conditions precluding more formal celebration of the centenary.

Association of Mining Electrical Engineers.—At a meeting of the Yorkshire Branch on Saturday last, at Barnsley, a paper on "Economies in Colliery Electrical Plant" was read. It was estimated that electrical power to the extent of something like one million horse-power was at present in use in British collieries. The principal directions in which economies could be effected were in the utilisation of low-grade coal and gas from by-product plants for steam-raising purposes.

South African Institution of Engineers.—The following awards have been made for the past session:—Institution's Gold Medal and Certificate: Mr. Andrew Fenwick, for his paper on "The Deterioration of Curtis-Rateau Turbine Blading." Central Mining-Rand Mines Award: Messrs. T. C. Otley and Verney Pickles, for their joint paper entitled "Boiler-house Operation and Maintenance." Price Award: Divided between two theses, entitled respectively "Comparative Merits of Steam Turbines and Reciprocating Engines," by Mr. M. Kindinger, and "The Lay-out of a Distributing Station, with Special Reference to Safety Measures," by Mr. W. H. F. Tredre (student members).

Appointments Vacant.—Two charge engineers for the Hereford Electricity Works; charge engineers (50s.) for the R.E. York. Command; power station staffs for the Ordnance Depôts, aerodromes, and military camps in the Southern Command; switchboard attendant (51s.) for the Battersea B.C. Electricity Department; shift engineer (42s. +) for the Swansea Harbour Trust; sub-station attendant (49s.); cable jointer for the Stalybridge, &c., Joint Tramways and Electricity Board; assistant engineer, shift engineer, and draughtsman for Edmundson Electricity Corporation; switchboard attendant (35s. +) for the Walthamstow U.D.C. Electricity Department; shift engineer for Keighley Borough Electricity Works; shift engineer for Eccles Corporation Electricity Department. See our advertising pages to-day.

The Siemens Shares.—The *Daily Mail* states that after long negotiations between the Board of Trade and several syndicates of would-be purchasers, "a contract has been entered into for the sale of the German shares in Siemens Bros., Ltd., of Woolwich and Stafford, electrical engineers. The successful syndicate consists of British-born subjects. It is their intention to carry on and expand the business, which has been supported by Government war contracts."

Raising the Price of Gas.—In the Bill by which the South Metropolitan Gas Co. proposes to alter its powers, the company asks that its capital may be increased by £1,000,000, and for the purposes of dividends that the sliding-scale charge shall be increased from 3s. 1d. to 3s. 7d. per 1,000 cb. ft. This increase is "to continue for two years after the termination of the war" or such longer period as the Board of Trade may determine.—*Daily Chronicle.*

Educational.—Recognising how important it is that technical education should be fostered, Messrs. J. Stone & Co., Ltd., of Deptford, S.E., are encouraging the boys employed in their works to take full advantage of the valuable facilities afforded by the evening classes of the L.C.C. and other institutions in the neighbourhood. Prizes will be awarded on the results of the class work, and to induce those who are not already attending such classes to take advantage of the scheme and begin their technical training at once, the company is paying the fees of a number of boys for whom three new special classes are now being opened. The L.C.C. officials have very readily undertaken the organisation and tuition for these special classes, and it is hoped that the encouragement given the boys (over a hundred are affected by the scheme) will have permanently good results.

Advanced Electric Light Switching.—A few weeks ago we commented on the issue of a new Preliminary Grade Exam. Paper in Electric Light Switching; we have now received a new paper dealing with the Advanced Grade. The first line of the first question reads, "Modern tumbler switches have either 2, 3, 4, 5, or 6 terminals," and will remind many people that their knowledge of this fact, and all that it leads up to, is imperfect. The paper comprises 14 questions in all, and examinees may work 8, 9, or 10 of them. The questions cover an extremely wide range. For example, No. 3 deals with the testing and sorting of wires when the time comes to fit the switches of a certain circuit; No. 5 with tube wiring; No. 8 with C.T.S. ditto; and No. 11 with earthed concentric. Other questions relate to the uses of special tumbler switches in heater, small motor, and instrument circuits. Anyone can obtain a copy of the paper by applying to Messrs. A. P. Lundberg & Sons, 477-489, Liverpool Road, London, N. 7.

Re-Opening of the Science Museum.—The Science Museum, South Kensington, was re-opened to the public on Tuesday last, after having been closed to them for nearly two years; it has, however, been open without interruption for students. The greater part of the Museum will be open free on every week day from 10 a.m. to 5 p.m., and on Sundays from 2.30 p.m. to 5 p.m.

The collections contain many unique objects of great interest as representing discoveries, inventions and appliances that have been of first-rate importance in the advancement of science and industry, and it is gratifying that these are again available for inspection by visitors to London from all parts of the Empire. In our opinion the closing of this and other science museums was a grave error on the part of the authorities.

Calendars Wanted.—Lieut. F. L. Cater, A.M.I.E.E., will be glad if manufacturers will send some 1918 calendars for workshop and office use, addressed to him as follows:—882 M.T. Company, A.S.C., Halkin Street, London, S.W. 1.

OUR PERSONAL COLUMN.

Central Station and Tramway Officials.—Mr. Robert Hunter, who has occupied the position of station engineer for the greater part of the 19 years that he has been associated with the Aberdeen Corporation electricity department, recently tendered his resignation. On December 26th the staff and employés held an informal meeting in the works to bid him farewell. Mr. Bell presided, and expressed regret at Mr. Hunter's departure. The other speakers were Messrs. Clark, Burnett, McKay, Ross, Fyfe, and Downie. In the name of those present Mr. Bell, on behalf of the staff and employés, presented Mr. Hunter with a gold albert and a suitably inscribed silver matchbox.

A letter has been received by the Leeds Tramways Committee from the Board of Admiralty thanking the Corporation for placing the services of Mr. J. B. Hamilton, the tramways manager, at their disposal during the past year, and paying a high tribute of appreciation to the excellent work which he has done, and the knowledge and ability he has displayed. The Admiralty express the hope that his services may again be placed at their disposal if required, although in the meantime he has been transferred to the Board of Trade in connection with the Tramways Control Committee appointed to deal with congested tramway Control Committee appointed to deal with congested tramway traffic in munition areas. In that office it is hoped Mr. Hamilton may be able to assist the Tramways Committee in obtaining essential labour and material from districts in which at the moment they are not so urgently required. The Committee have conveyed to Mr. Hamilton their congratulations on the Admiralty letter, and have extended to him the privilege of placing his services at the disposal of the nation, keeping in touch meanwhile with local matters.

The Newport (Mon.) Council has confirmed a recommendation of the Electricity Committee that Mr. Nichols Moore be granted a further increase in salary of £50 per annum as from January 1st.

The Todmorden Council has granted an advance of £50 per annum in the salary of the borough electrical engineer, Mr. Joseph Boyce.

General.—We regret to learn that Mr. T. H. Harrison, of Messrs. Davey, Paxman & Co., Ltd., London, was seized with paralysis down his left side on December 7th. He is at present living at 26, Abbey Road, Brighton. Although he is now better, it will be a long time before he is about again. We are sure that Mr. Harrison's numerous friends and admirers in the electrical world will be anxious to join with us in sympathising with him in his enforced inactivity, and in expressing a hope that his recovery may be as speedy as possible.

Mr. Lee Murray has removed his offices from 10, Norfolk Street, Strand, W.C. 2, to 56, Victoria Street, Westminster, S.W. 1.

Mr. H. W. Teeton, electrical engineer, who is in business at Hanley, has received a commission in the Motor Transport, A.S.C. On the outbreak of war he was mobilised with the Staffordshire Yeomanry, and on the expiration of his time in January, 1916, he entered the Army Service Corps as an electrician. After 18 months' service in France he was recommended by his Colonel for a commission. He has now gone to the Eastern theatre of war. In his absence his business is being carried on by his wife.

Mr. Herbert R. Kemp, on the staff of the Yorkshire Electric Power Co., has been appointed electrical and mechanical engineer to Messrs. J. H. Andrew & Co., Ltd., Toledo Steel Works, Sheffield.

Roll of Honour.—We regret to record that the younger son of Mr. C. G. Tegetmeier, of the British Electric Traction Co., Ltd.,—Alan Tegetmeier, of the London Regiment—has been killed in action, aged 26 years. Private Tegetmeier was on the staff of the British Electrical Federation.

The Military Medal for bravery and devotion to duty by keeping telephone lines in repair under shell-fire has been awarded to Signaller T. C. Owen, King's Shropshire L.I., who was an electrician with Messrs. Smallwood & Co., of Shrewsbury.

Corporal J. Cleator, who has died of wounds received in action, served his apprenticeship with Mr. John Ellwood, electrician, of Whitehaven.

Private G. McKelvey, reported killed after being missing since April, was, up to his enlistment, a meter inspector in the electricity department of the Ilford U.D.C.

Rifleman W. Passmore, who has died in a French hospital from the effects of gas poisoning and bronchitis, was an electrician at Swansea.

Corporal C. W. Horley, Sherwood Foresters, who has died of wounds, was in the winding department of the B.T.H. Co., at Rugby.

Private S. Hughes, Royal Welsh Fusiliers, who was an electrical engineer at Llanfair (Montgomeryshire) when he enlisted at the outbreak of war, has gained the Military Medal for repairing telephone wires under heavy shell-fire.

Drummer H. Pickles, West Yorks. Regiment, who is in hospital with trench fever, was employed by Mr. Harry Moss, electrician, Bradford.

Pioneer W. A. Hayes, R.E., who has been killed at the Front, was with Messrs. T. Garnett & Co., electrical engineers, Manchester.

Private T. Harrington, Connaught Rangers, awarded the D.C.M., was a motorman on the Bury Corporation tramways.

Lieut.-Col. A. B. Layton, South Lancs. Regiment, who has again been mentioned in dispatches, was electrical engineer and departmental manager at the works of Messrs. J. Crosfield & Sons, Ltd., Warrington.

Private G. H. Parkinson, of the K.S.L. Regiment, who has died of wounds, was employed by Messrs. Baxendale and Co., Ltd., Manchester.

Private G. Walker, of the Middlesex Regiment, who has been awarded the Military Medal, was in the superintending [illegible]

William Howarth, electrical artificer, lost his life by the sinking of the armed boarding steamer *Stephen Furness* in the Irish Sea. He was 22 years of age, and [illegible] the Naval Reserve was an electrician with a Manchester firm.

Private Newton, Leicestershire Regiment, who has fallen in action, was engaged as electrician at Swynnerton Hall.

Private R. S. Longden, of the electrical department of the North Staffordshire Railway Co., has been killed in action.

Sapper P. Hirst, formerly in business as an electrician at Huddersfield, has been wounded.

Lance-Corporal J. Lynch, one of the employés in the Stockport electricity department, has been awarded the D.C.M., and the Council has forwarded its hearty congratulations.

Lieutenant (S.R.) Egerton J. Ward, A.M.I.E.E., Royal Irish Regiment, mentioned in Sir Douglas Haig's recent dispatch for gallant service on the Western Front, was on the staff of the Pará Electrical Railways & Lighting Co., Ltd., Brazil.

Obituary.—Sir W. H. Lindley.—The *Times* records the death, which occurred at Putney on Sunday, at the age of 64 years, of Sir William Heerlein Lindley, M.Inst.C.E., who had for very many years been engaged in a prominent capacity in connection with Continental waterworks, electrical undertakings, sewerage works, &c. Among other works with which he was concerned were the electricity works at Elberfeld. The *Times* states that "the regard in which he was held in German engineering circles is shown by the fact that he acted as president of the Engineering Standards Commission of the German Gas and Waterworks Engineers, and also of the commission on stray electric currents from tramways. He became a member of the Institution of Civil Engineers in 1878, and received a knighthood in 1911 on the ground of the services he had rendered to the Royal Commission on Canals and Waterways, for which he prepared elaborate reports on the waterways of France, Belgium, and Germany, with some notes on those of Holland."

Mr. E. W. Newton.—The death occurred on December 30th, at the age of 44 years, at Monkseaton, of Mr. Edgar Williams Newton, of H.M. Postal Telegraphs.

Mr. Reuben Marchant Sayers.—We much regret to announce the untimely death from typhoid fever of Mr. R. M. Sayers, A.M.Inst.C.E., M.I.E.E., partner in the firm of Messrs. Clark, Forde, Taylor & Erskine-Murray. Mr. Sayers was educated at St. Paul's School, and was trained in electrical and engineering work at the City and Guilds Institute, South Kensington, of which he was a prominent student. In 1897 he joined his firm as an assistant engineer, and for 20 years has been associated in the important works which they have undertaken. Those whose privilege it had been to know him intimately for all of those years know that his ability and character earned everyone's esteem, and the many letters received are eloquent testimony of the regard felt for him as an engineer and as a man who endeared himself to all with whom he came in contact in the course of his career. Sayers's first work on submarine cables was in connection with the laying of the Bermuda-Turk's Island-Jamaica Cable in 1898, and in the 19 years following he led a busy life, acting as chief assistant, and afterwards (in 1910), when he became a partner in the firm, on many cable-laying expeditions, amongst which may be mentioned the Pacific cable and the laying of the Commercial Co.'s cables as under:—Fayal (Azores) and Canso (Nova Scotia), Weston-super-Mare and Waterville (Ireland), New York and Havana, diversion of Atlantic cable to St. John's, Newfoundland, extension of St. John's-Canso cable to New York, and several successful deep-sea repairing expeditions, in all of which he carried out the work undertaken to the full satisfaction of his firm and of the cable companies for whom he was acting. Mr. Sayers possessed abilities in such a marked degree, and was so earnest in all he undertook, that he will leave his mark on the calling which he had chosen, and for which he was especially fitted by sound knowledge, ability, and charm of manner. He contributed papers on electrical subjects to the technical journals, and amongst these we have in mind [illegible] the Electrometer in Cable-testing," "Temperature Coefficient for Loss of Charge of Paraffin Paper Condensers," &c., &c. Quite recently he attacked the difficult problem of computing the depreciation of submarine cables, and his death has deprived us of an important paper on this subject. His services to the various cable companies for whom he has acted have been recognised in the fullest and most sympathetic way. [illegible] "spade work" that is [illegible] by [illegible]

NEW COMPANIES REGISTERED.

Watertight Fittings, Ltd. (149,159).—Private company. Registered December 18th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in watertight fittings in connection with the supply of electricity for lighting, heating, and power, or in connection with any trade, &c. The subscribers (each with one share) are:—R. Eyre, [illegible] Works, Chesterfield, merchant; J. J. Eyre, Holywell Street, Chesterfield, house furnisher. The first directors are to be appointed by the subscribers. Solicitor: W. F. Wakerley, Chesterfield, Derby.

Berry's Electric, Ltd. (149,161). Private company. Registered December 18th. Capital, £50,000 in £1 shares. Electrical and general engineers, &c. The subscribers (each with one share) are:—H. H. Berry, 86, Newman Street, W., engineer; F. G. Koch, 10-11, Austin Friars, E.C., [illegible]. The first directors are to be appointed by the subscribers. Registered office: 86, Newman Street, Oxford Street, W.

Northumbria Motors, Ltd. (149,201).—Private company. Registered December 31st. Capital, £25,000 in £1 shares. Electrical, mechanical, [illegible], and general engineers and contractors, manufacturers of machinery, tools, lamps, dynamos, engines, rheostats, and electrical apparatus, dealers in motor cars, waggons, cycles, and tricars (steam, petrol, gas, or [illegible]), &c. The subscribers (each with one share) are:—W. O. Sykes, Newlands, Horbury, near Wakefield, athletic goods manufacturer; S. Cox, 8, Cotton Street, Wakefield, cashier. The first directors are to be appointed by the subscribers. Solicitor: J. Charlesworth, The Crofts, Horbury, near Wakefield, Yorks.

Pyne, Hughman & Co., Ltd. (1,638F).—Particulars filed December 19th, 1917. Registered in Calcutta March 1st, 1916, to take over the business of Pyne, Hughman & Co., and to carry on the business of engineers, builders, contractors, ironfounders, electrical engineers, ship, boat, carriage, and motor builders, &c. Capital, Rs. 3,10,000 in 3,100 shares of Rs. 100 each. British address: 329, High Holborn, W.C., where F. M. Short (manager in the United Kingdom) is authorised to accept service.

British Expert Engineers & Precision Tool Manufacturers, Ltd. (149,193).—Private company. Registered December 20th. Capital, £4,000 in 1,400 pref. shares of £1 each and 390 ord. shares of £5 each, and 26 founders' shares of £25 each. Precision tool manufacturers, electrical, heating, mechanical, and general engineers and metal workers, &c. The subscribers are:—E. A. Boynton, 37, Church Lane, Hornsey, N., engineer, 14 founders' shares; F. C. Dowsett, 100, St. George Avenue, Tufnell Park, N., engineer, 12 founders' shares. The first directors are:—E. A. Boynton and F. C. Dowsett. Registered office: 22, Cross Street, Islington, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rapid Distillation & Power Co., Ltd.—Charge dated December 6th, 1917 (supplemental to charge of November 27th, 1917), securing £15,462 of and all moneys which may be paid by Lieut.-Col. W. G. Morden and C. W. Small under a certain guarantee. Property charged: The company's undertaking and property, present and future, except uncalled capital.

Chamberlain & Hookham, Ltd. (59,920).—Capital, £100,000 in 10,000 ord. and 10,000 pref. shares of £5 each. Return dated June 14th, 1917 (filed November 20th). 10,000 ord. and 8,000 pref. shares taken up; £36,490 paid on 7,298 pref.; £53,510 considered as paid on the remainder.

Brecknell, Munro & Rogers, Ltd. (79,766).—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated November 19th, 1917. 1,058 pref. and 14,829 ord. shares taken up; £5,673 10s. paid on 1,058 pref. and 767 ord.; £7,031 considered as paid on 14,162 ord. Mortgages and charges: £7,900.

Pirelli, Ltd. (103,068).—Capital, £40,000 in £5 shares. Return dated October 26th, 1917. All shares taken up; £40,000 paid. Mortgages and charges: Nil.

New St. Helens & District Tramways Co., Ltd. (59,426).—Capital, £150,000 in 20,000 pref. and 10,000 ord. shares of £5 each. Return dated November 9th, 1917. 15,980 pref. and 9,000 ord. shares taken up; £125,410 paid, including £510 on 1,020 shares forfeited. Mortgages and charges: Nil.

Blackburn, Starling & Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated July 27th, 1917. All shares taken up. £8,100 paid, £3,900 considered as paid. Mortgages and charges: Nil.

Guildford Electricity Supply Co., Ltd. (36,725).—Capital, £55,000 in 25,000 pref. shares of £1 each and 6,000 ord. shares of £5 each. Return dated September 10th, 1917. 18,856 pref. and 3,059 ord. shares taken up. £[illegible]4,153 paid, including £2 on two ord. shares forfeited. Mortgages and charges: £40,000 (£25,000 first and £15,000 second mortgage debentures).

Drake & Gorham, Ltd. (70,275).—Capital, £125,000 in £1 shares. Return dated November 22nd, 1917. All shares taken up. £85,000 paid; £40,000 considered as paid. Mortgages and charges: Nil.

British Electric Traction Co., Ltd. (49,855).—Capital, £2,998,307 15s., of which, to July 6th, 1917, £712,744 5s. had been issued as 6 per cent. cumulative participating preference stock and £1,326,263 10s. as ordinary stock. Total amount paid: £2,039,007 15s. Mortgages and charges outstanding at date named: £1,866,042.

Ely Valley Lighting Co., Ltd. (78,637).—Capital, £5,000 in £1 shares. Return dated November 15th, 1917. 3,471 shares taken up; £3,473 10s. paid, including £2 10s on 10 forfeited shares. Mortgages and charges: Nil.

Frinton-on-Sea and District Electric Light & Power Co., Ltd. (70,689).—Capital, £10,000 in 7,300 pref. and 2,700 ord. shares of £1 each. Return dated July 26th, 1917. All shares taken up; £10,000 paid. Mortgages and charges: £10,000.

Yorkshire Cable Co., Ltd.—Satisfaction in full on November 6th, 1917, of debenture dated June 19th, 1912, securing £1,200.

Satisfaction in full on November 6th, 1917, of debenture dated October 8th, 1914, securing £800.

Debenture dated December 10th, 1917, to secure any sum, not exceeding £4[illegible], which W. S[illegible] and R. R. S[illegible] may be called upon to pay under guarantee. Property charged: The company's undertaking and property, including uncalled capital.

Rushmores, Ltd.—Particulars of £30,000 debentures created December 19th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

H. T. Boothroyd, Ltd. (99,742).—Capital, £20,000 in £1 shares (15,000 ord. and 5,000 pref.). Return dated December 3rd, 1917. 10,002 ord. and 2,800 pref. shares taken up. £2,802 paid on 2,800 pref. and two ord.; £10,000 considered at paid on 10,000 ord. Mortgages and charges: £7,509.

Enfield Electric Cable Co., Ltd. (131,995).—Capital, £50,000 in £1 shares. Return dated November 6th, 1917. 32,800 shares taken up. £32,800 paid. Mortgages and charges: £35,000. (Alien enemy holdings have been eliminated during 1917.)

Dartmoor Electric Supply Co., Ltd. (110,871).—Capital, £2,000 in 10s. shares (reduced from £4,000 in £1 shares in 1916). Return dated June 30th, 1917. All shares taken up. £2,000 paid. Mortgages and charges: £4,000.

CITY NOTES.

The Société Industrielle des Téléphones.

The report of the directors of the *Société Industrielle des Téléphones, of Paris*, which has an ordinary share capital of £720,000, and owns several works for the manufacture of telephone and submarine cables, ebonite, electrical apparatus, &c., was submitted to the general meeting held on December 15th. It deals with the year ended on June 30th, 1917, and states that the continuation of the war caused an increase in the consumption of telephone cables, and of all other products required for purposes of national defence. The company's efforts still further to develop the production were redoubled, and the turnover notably increased. As, however, the general expenses did not advance in the same proportion the net profits permitted of the payment of a dividend of £1 12s. per share, notwithstanding the considerable rise in wages, raw materials, and of taxation. If this immediate result was satisfactory, the situation was not without causing pre-occupation on account of the excessive wear and tear of the machinery and plant. The scarcity of trained workers had compelled the company to entrust the plant to a *personnel* who were frequently inexperienced, and the necessity for day and night working increased the depreciation. As a consequence, it was proposed to apply a sum greater by £40,000 than in the previous year to the writing down of the installations. This augmentation was not excessive when it was considered that the almost complete renewal of the equipment would be necessary after the cessation of hostilities, and that as its original value would be completely redeemed by that time the expenditure on replacement would then exceed twice the pre-war cost. It was for this purpose that the directors also asked, after the payment of the dividend, the transfer from the balance of £64,000 to the prevision fund which was formed in the previous year. As was mentioned in the report for 1915-16, it was essential for the company to have available the necessary resources for the reorganisation of the works after the war in order to ensure the future prosperity of the undertaking and maintain the position which it had occupied in the industrial world for 25 years. It was, therefore, intended to proceed by way of extensions, so as to avoid any interruption in working, and obtain the best arrangements. Sites had been acquired for these purposes adjoining the works in the Rue des Entrepreneurs et de Levallois for the extension of telephony and apparatus, and adjacent to the Bezons works for new shops and the transfer of a portion of the rubber manufacturing. The accounts show a credit balance of £313,000. After placing £100,000 to the depreciation fund, £29,000 to the legal reserve fund, £64,000 to the prevision fund, and making other appropriations, the balance permits of the payment of £1 12s. per share, or at the rate of 13¾ per cent.

British Columbia Electric Railway Co., Ltd.

The directors' report for the year ended June, 1917, shows that after making provision for renewals maintenance £101,459, income-tax £15,000, and addition to capital amortisation fund £2,762, the net revenue is £160,844, plus £6,860 brought forward, and £44,000 transferred from reserve (in order to make the dividend payment), making £211,704. Interest on debenture and debenture stock for the year absorb £132,671, and dividends already paid on the 5 per cent. cumulative perpetual preference stock for the year £72,000, leaving £7,033 to carry forward. The above figures represent an improvement of approximately £26,000 over the results of the previous year. The report of the Government Commissioner on his investigation of the question of transportation in the City of Vancouver and the surrounding districts in its findings and recommendations justifies the past policy and operations of the company, and is not only an answer to criticisms, but upholds the contentions of the directors and management in regard to the Jitney competition. Negotiations are now proceeding with a view to making arrangements for giving effe to the Commissioner's recommendations, and, pending th outcome of these negotiations, the directors are of opinio that it is not advisable to deal further with the situatio arising out of the recent amendments to the Vancouver Incorporation Act explained in the statement issued to th stockholders in July last. A further statement will be issue to the stockholders as soon as the arrangements have bee completed. For the first four months of the current ye the gross earnings show an increase of approximately $146,81 This increase has, however, been more than absorbed by i creased expenses due to higher wages and increased co materials, in consequence of which the net earnings for the period show an approximate decrease of $2,648. Having regard to the uncertain outlook for the immediate future, it is prudent to postpone the payment of the interim dividend payable January 15th, 1918, on the 5 per cent. cumulative perpetual preference stock. If, however, at the end of the financial year an improvement in the operating results is shown, the whole or part of the dividend may be distributed in July next, and a resolution giving authority to the directors to draw on the reserve fund so far as may be necessary for this purpose will be submitted to the annual meeting on January 4th.

British Coalite Co., Ltd. Speaking at the annual meeting, the Chairman, Mr. W. J. Fisher, said that the future of British industry must be largely influenced by the price at which power on a large scale could be supplied in the form of electric current if, as a nation, they were to compete successfully in the manufacture of products which in the past had to a considerable extent been obtained from countries in which water power was available. The board had been anxiously considering how to provide for the rapid erection of Coalite plants all over the country, and had decided to arrange for the development of the process on a royalty basis with a financial group. An agreement of this nature had been made with Low Temperature Carbonisation, Ltd., which was creating an entirely new organisation with a view to future developments. Should this arrangement prove successful the quantity of coal carbonised by their process would greatly exceed 700,000 tons per annum. The ultimate result could not be doubtful. The report of the Coal Conservation Sub-Committee advocated the substitution of gas fuel in place of crude coal for the production of electrical energy. The proposal was to divide the country into districts, and create large generating stations whence electrical energy could be distributed. For the full attainment of this ideal the distillation of coal at low temperatures was indispensable, and this would materially strengthen the position of this and its allied companies.

Cordoba Light, Power and Traction Co., Ltd. During the year there has been a deficiency in the supply of water from San Roque Lake, and in consequence over 25 per cent. of the energy required to supply the customers and tramways was generated by steam. At times it was necessary to curtail the supply of current to consumers, and in consequence of this and of a strike on the tramways in sympathy with the railway strike, the taking of the subsidiary companies were reduced by about £3,500, while the extra expenses due to steam operation alone were over £34,000, or £11,000 more than the previous year. As a result of the abnormal working expenses, says the *Financial Times*, the profits were not sufficient to meet all the charges, and the profit and loss account shows a loss of £17,721. This has been deducted from the amount brought forward, leaving a balance of £8,630, which the directors recommend be carried forward.

Sir G. A. Touche, M.P., presided at the annual meeting on Monday. He said that perhaps no companies had been hit worse in the war than those operating abroad in countries where it was necessary to import fuel. Had there been anything approaching a normal rainfall they would have been, not altogether, but in a large measure, independent of the fuel problem, and of some of the worst trading results of the war. The effect of the drought would be understood when he mentioned that the expenditure on the operation of their steam plant, which was £985 in 1915, rose to £23,700 in 1916, and to £35,000 in 1917. It would be contrary to all experience to expect so great a failure of water three years in succession. If they could revert to a position where the hydraulic energy was nearly sufficient they might see a swift change in their fortunes. During the whole year the situation in Cordoba, and, indeed, in the Argentine generally, had been one of exceptional difficulty, but the results of the six months ended September 30th, 1917, had been considerably better. The gross receipts of the combined businesses had amounted to £158,806, compared with £162,460 in 1916, and £157,590 in 1915, and considering the difficulties of the year, such takings were not unsatisfactory. Their misfortunes, however, stood revealed in the growth of expenses. In 1915 they were £74,270, in 1916 £100,539, and in 1917 £111,532. The present position of affairs in the Argentine was rather more promising. They must not look for normal results while the war lasted, or for some time after, although they might hope for an amelioration of the conditions caused by the drought.

Venezuela Telephone & Electrical Appliances Co., Ltd.—Profit £18,237, plus £11,222 brought forward. After providing for debenture interest, &c., and £2,399 for excess profits duty, the directors propose a dividend of 8 per cent. on the preference shares, putting £6,000 to reserve for renewals and depreciation, and carrying forward £15,057 to undivided profits account. For the previous year 30 per cent. was paid on the preference shares, leaving arrears as from October 1st, 1910, while during the present year holders of the preference shares released their right to all arrears of dividend up to June 30th, 1916, in consideration of the transfer to them of certain shares in another company.—*Financial Times.*

Buenos Aires Port & City Tramways, Ltd.—The report for the period from June 18th, 1915, to June 30th last states that through the receiver statements of working in Buenos Aires have been received, and the accounts are based upon the figures so supplied. For the period of one year and 12 days to June 30th, 1916, the result, after allowing for certain charges by the receiver in Buenos Aires and London, showed a surplus of £9,335, and for the year ended June 30th, 1917, a surplus of £3,810. The total sum in respect of interest on the 6 per cent. debentures remaining unpaid amounted at June 30th, 1917, to £108,406. No scheme of reconstruction has yet been formulated by the receiver of the debenture holders, and, according to the *Financial Times*, the directors cannot hope that any effective steps can be taken for this purpose until after the termination of the war.

Companies Struck Off the Register.—The following have been struck off the register and are dissolved:—

Eastern Electric Co., Ltd.
Electrical Engineering & Motor Co. (Carlisle), Ltd.
Marine & General Oil Engines, Ltd.
Standard Bolt & Nut Co., Ltd.
Transport Development & Power Syndicate, Ltd.
X.L. Electric Co., Ltd.

Burmah Electric Tramways & Lighting Co., Ltd.—Profit for year to July 31st, £9,498. £3,000 is put to reserve for depreciation and £500 to reserve for depreciation of investments. Dividend, 6 per cent. on preference shares, against 5 per cent. for each of three preceding years (leaving arrears of 53 per cent.), and carrying forward £500.—*Financial Times.*

Humphrey Pump Co., Ltd.—War conditions have again adversely affected the company's business. The company has been engaged for some time on a general engineering contract for the Government. The profit and loss account shows a deficiency of £5,913, making the total deficiency £32,288.

Victoria Falls & Transvaal Power Co., Ltd.—Six months' dividend at the rate of 6 per cent. per annum, less income-tax, on the preference shares.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Final dividend at rate of 6 per cent. on 6 per cent. cumulative preference shares.

Chile Telephone Co., Ltd.—Interim dividend, 3 per cent., tax free, on ordinary shares.

Coventry Chain Co., Ltd.—Dividend for the year on the ordinary shares 10 per cent., and a bonus of 5 per cent., less tax.

STOCKS AND SHARES.

New Year's Day, 1918.

By far the most important event of the year of electricity finance befell at its very end, in the publication of the interim report by the Coal Conservation Sub-Committee on the Supply of Electric Power in Great Britain. "A haphazard multiplication of small generating plants situated not at points where generation can be effected most cheaply," is the sweeping description of present arrangements for electricity supply, with over 600 undertakings to deal with them; 70 separate generating stations in Greater London, working 49 different systems of generation. The Sub-Committee suggests 16 districts for Great Britain, with one authority in each district to deal with all the generation and main distribution, and it estimates that a saving of one hundred million pounds in cash and 55 million tons of coal could be effected under its proposals.

Such a huge scheme has been the dream of far-seeing electrical reformers for at least twenty years. Various efforts have been made to work it out on a modest scale, but slender success has met every attempt. What the scheme, if brought into practical politics, will mean to existing companies, nobody knows, and the Stock Exchange List of prices remains unchanged from beginning to end.

Substantial variations in prices have occurred, however, since the end of 1916. London lighting shares show a large preponderance of rises over falls; the Telegraph list is equally satisfactory to holders. Home Railway stocks have given way, and so have many of the issues in companies dealing with transport abroad. Manufacturing shares wind up the year well, and have useful rises to their credit. The British Insulated has divided its £5 shares into £1 shares, and, on the basis of the former, the price is 65s. to the good, while General Electrics are £6 up. Consideration of our usual comparative tables will leave a comforting effect upon those who feared, twelve months ago, that the third year of war would play havoc with the fortunes of companies engaged in electrical or allied work, and this experience may be of hopeful augury in regard to the New Year just beginning. We accordingly present the following selections from our regular weekly Lists of Stocks and Shares:—

Home Electricity Companies.

Ordinary Shares.	Dec. 29th, 1916.	Dec. 31st, 1917.	Rise or fall.	Ordinary Shares.	Dec. 29th, 1916.	Dec. 31st, 1917.	Rise or fall.
Brompton ..	6⅝	6½	— ⅛	London Electric .	1⅝	1	— ⅝
Charing Cross ..	3⅝	4	+ ⅜	Metropolitan ..	2¼	3¼	+ 1
Chelsea ..	3	2⅞	— ⅛	St. James' .	6	7	+ 1
City of London ..	11⅝	13¼	+ 1⅝	South London ..	2¾	3	+ ¼
County of London	10⅝	11	+ ⅜	Westminster ..	[illegible]	[illegible]	+ [illegible]
Kensington ..	5½	5⅜	— ⅛				

Ordinary Shares.	Dec. 29th, 1916.	Dec. 31st, 1917.	Rise or fall.	Ordinary Shares.	Dec. 29th, 1916.	Dec. 31st, 1917.	Rise or fall.
TELEGRAPHS AND TELEPHONES.							
A.-Am. Pref.	95½	95½	-	Indo-European ..	49½	52½	+ 3
Cuba Submarine	8¼	9¼	+ 1	Marconi	2⅝	3⅜	+ ¾
E. Extension ..	14	15	+ 1	Oriental Telep. ..	2 5/16	3	+ 11/16
E. Telegraph	140½	150½	+ 10	United R. Plate ..	6 1/16	6 13/16	+ ¾
Globe Tel. & Trust	12¼	13¾	+ 1½	W. India & Pan.	1	1 7/16	+ 7/16
Great Northern ..	37	36	— 1	Western Teleg. ..	13¾	15¼	+ 1½
HOME RAILS.							
Cen. London Ord.				Under. Elec Ord.	2¼	1⅝	— ⅝
Assented	65½	60½	5	do. do. "A"	6/6	5/-	1/6
Metropolitan	25	22¼	— 2¾	do. do. Inc. ..	92½	81	11½
Met. District ..	16¾	16	¾				
FOREIGN TRAMWAYS, &c.							
Anglo-Arg. Trams.				B. Col. Elec. Def.	35½	28	7½
2nd Pref.	3	2½	½	Mexico Trams 5 p.c.	32½	27½	5
Brazil Tractions	49	45	4	M'x'can L'g't Com	7½	17½	+ 10
B. Col. Elec. Prfce	62½	42½	— 20	do. Pref. ..	15½	29	+ 13½
do. do. Pferrd	40½	30	10½	do. 1st Bonds	27½	32½	+ 5
MANUFACTURING COMPANIES.							
Babcock & Wilcox	2 11/16	3¼	+ 9/16	Edison Swan f. p.	1⅞	2⅜	+ ½
Brit. Aluminium ..	1 5/16	1 13/32	+ 3/32	Elec. Construction	1 1/16	1¼	+ 3/16
Brit. Insulated ..	11¾	3	+ 3¼	Gen. Elec. Ord. ..	13¾	19¾	+ 6
B. West. Pref. ..	2⅜	2 11/16	+ 5/16	Henleys	16	16½	+ ½
Callenders ..	13	14½	+ 1½	India-Rubber ..	13½	14¼	+ ¾
Castner-Kellner ..	3 9/16	3 13/32	— 5/32	Telegraph Con. ..	38	41½	+ 3½

In these days of paper shortage, when many clients will, perforce, miss the receipt of the customary Stock Exchange Official List from their stockbrokers, we hope that the above catalogues of quotations may prove of more than ordinary use, but this hope is subsidiary and insignificant compared with the cordial wish of a more happy and prosperous New Year to the patient followers of these notes.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4½	3⅜	—	6 13 4
Chelsea	4	3	2¾	—	6 9 1
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London*	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅜	—	5 9 8

TELEGRAPHS AND TELEPHONES.

	Dividend 1915.	Dividend 1916.	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	95½	— ½	6 5 6
do. Def.	38/6	1½	2⅜	—	6 8 4
Chile Telephone	8	8	7 1/16	—	6 11 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15	—	*5 6 8
Eastern Tel. Ord.	8	8	150½	—	*5 6 4
Globe Tel. and T. Ord.	7	7	13½	—	*5 1 10
do. Pref. ..	6	6	10⅛	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	52½	—	6 3 10
Marconi	10	15	3⅛	+ 1/16	4 14 9
Oriental Telephone Ord. ..	10	10	8	—	3 6 8
United R. Plate Tel.	8	8	6 13/16	—	*5 17 6
West India and Pan.	6d.	6d.	1 7/16	—	*3 9 6
Western Telegraph	7	8	15¼	—	*5 5 0

HOME RAILS.

	Dividend 1915.	Dividend 1916.	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	22¼	+ ½	*4 10 0
do. District	Nil	Nil	16	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	81	—	*4 18 9

FOREIGN TRAMS, &c.

	Dividend 1915.	Dividend 1916	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2½	— ⅛	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	65½	— 1	7 11 3
Brazil Tractions	4	4	45	— ½	—
Bombay Electric Pref.	6	6	9⅝	—	6 4 9
British Columbia Elec. Rly. Pfce.	5	5	42½	—	11 15 4
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	56	—	7 11 9
Mexico Trams 5 per cent. Bonds	Nil	Nil	27½	— 5	Nil
do. 6 per cent. Bonds	Nil	Nil	27½	— 5	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	32½	—	—

MANUFACTURING COMPANIES.

	Dividend 1915.	Dividend 1916	Price Dec. 31, 1917.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3¼	+ 1/16	4 12 6
British Aluminium Ord. ..	7	10	1 13/32	—	6 5 9
British Insulated Ord.	17½	20	3	—	6 13 4
British Westinghouse Pref. ..	7½	7½	2 11/16	—	5 11 4
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	[illegible]xd	—	6 5 0
Castner-Kellner	22	20	3 13/32xd	—	5 17 8
Edison Swan, fully paid .	—	—	2⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½xd	+ 1½	5 6 0
Electric Construction	7½	7½	1⅛	—	6 13 4
Gen. Elec. Pref.	6	6	10¼	— ¼	5 17 3
do. Ord.	10	10	19¾	—	5 1 3
Henley	25	25	16½		7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14¼xd	-	*6 8 9
Telegraph Con.	20	20	41½	—	*5 15 7

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 2nd.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/6	..
a	Ammoniac Sal	per ton	£75	..
a	Ammonia, Muriate (large crystal)	,,	£58	..
a	Bisulphide of Carbon	,,	£23	..
a	Borax	,,	£38	..
a	Copper Sulphate	,,	£67 10/-	30/- inc.
a	Potash, Chlorate	per lb.	2/6	..
a	,, Perchlorate	,,	2/-	..
a	Shellac	per cwt.	£18	..
a	Sulphate of Magnesia	per ton	£16	..
a	Sulphur, Sublimed Flowers ..	,,	£35	..
a	,, Lump	,,	£25	..
a	Soda, Chlorate	per lb.	10½d.	..
a	,, Crystals	per ton	120/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c	,, Tubes (solid drawn) ..	,,	..	..
c	,, Wire, basis	,,	..	..
c	Copper Tubes (solid drawn) ..	,,	1/6¾ to 1/7¼	..
g	,, Bars (best selected) ..	per ton	£147	..
g	,, Sheet	,,	£147	..
g	,, Rod	,,	£147	..
d	,, (Electrolytic) Bars ..	,,	£125	..
d	,, ,, Sheets ..	,,	£152	..
d	,, ,, Wire Rods	,,	£133	..
d	,, ,, H.C. Wire	per lb.	1/3⅞	..
f	Ebonite Rod	,,	3/-	..
f	,, Sheet	,,	2/6	..
n	German Silver Wire	,,	2/3	..
h	Gutta-percha, fine	,,	6/10	..
h	India-rubber, Para fine	,,	2/10	4½d. inc.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g	Lead, English Pig	,,	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e	,, ,, ,, medium	,,	3/6 to 6/-	..
e	,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d	Silicium Bronze Wire	per lb.	1/8½	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	,,	..	..
n	,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

Factory Act Prosecution.—At the Hayward's Heath Petty Sessions, on December 31st, the Burgess Hill District Electric Supply Co. were summoned for two infringements of the Factory and Workshops Act, by employing a young person after prohibited hours on November 17th and 18th. It appeared from the evidence that Frederick Goldsmith, aged 17 years, worked for the company on November 17th, starting work at 9.30 or 10 a.m., and leaving at 1 p.m.; he returned between 3.30 and 4 p.m., and went on till 10 p.m. On November 18th he started at 3.30, and worked until 10.30 p.m. For the defendants, it was stated that the company was a small concern, and it was unfortunate for them that those cases had arisen, but it was all in consequence of the depletion of labour owing to the war, and the necessity to fill the ranks of the Army. The company before the war had four men working in day and night shifts in the engine room, and only one of these was now in the employ of the company. Mr. Prior, the manager, was now left with only a man and a boy to run the machinery. They had tried their very best to replace the men, but could not until lately, when they secured a discharged soldier. The electric light at Burgess Hill was a public necessity, and had to be kept going at all hazards. It was urged that there were grounds for mitigation of any penalty which might be imposed owing to the great trouble the company had had to fill up the vacancies on the staff at the works.

Mr. Edward Prior, the manager, said that before the war he had four able-bodied men in the engine room. Three had joined up. He could not get other men, and took Goldsmith on in their place. He had now taken on a discharged soldier. He had been working under great difficulties, and would be glad to fill up his staff. They had to shut down the works at 10.30. The lad Goldsmith was taken on in place of a man, and they expected him to work the same hours as a man. There was not so much current used in war time owing to the restrictions on lighting. The Chairman said the Magistrates took into consideration the great difficulty there was in obtaining labour, also that the electric works were of public utility. There must, however, be a conviction. Defendants would be fined 10s. in each case, and 1s. 3d. costs would be allowed in each case.

A Municipal Industrial Council.—London boroughs are being asked to set up a joint Industrial Council, representing the City Corporation and the City and Metropolitan Councils, and their workmen, to deal with differences as to wages and conditions of employment.—*Daily Chronicle.*

HIGH-EFFICIENCY AIR PUMPS FOR HIGH VACUA.

By E. JONES.

(*Abstract of paper read before the* Liverpool Engineering Society, *December 5th*, 1917.)

Claiming that the "multijector" air-pump has come to stay, and will challenge the supremacy of the reciprocating and rotary types, the author gives a detailed description of the Leblanc steam-operated ejector air pump in its present form. Fig. 1 is a sectional drawing of the complete apparatus. Steam is admitted into a receiving box through a strainer fitted with brass wire gauze of 40 to 60 mesh in two coils, arranged to be staggered so that it is almost impossible for foreign matter to pass through. The first stage nozzle plate is fitted with a ring of nozzles directed at a particular angle towards the axis; the nozzles are made to a high degree of accuracy, and are locked in position by a copper locking plate. The steam from the first-stage nozzles, with the air entrained, passes into the first-stage diffuser, the bore of which is accurately machined to provide for the proper compression of the air. The second-stage steam receiving box has a central core forming a continuation of the first-stage diffuser, with an outer annular space to permit the steam to feed the second-stage nozzles, and is provided with a strainer similar to that on the first-stage box. The nozzles in the second stage are more numerous and of larger size than in the first stage, and discharge into a mixing chamber which opens into a diffuser, whence the steam and air pass to the outlet. The whole of the apparatus is constructed of gun-metal; there are no intricate castings, and the parts are light and easily machined.

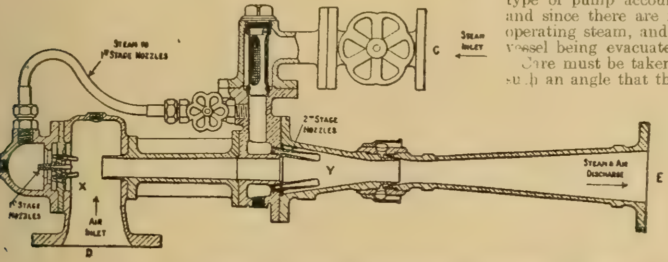

Fig. 1.—Section of Leblanc Multijector Air-pump.

The weight of air dealt with depends upon the weight of steam used, and the minimum steam pressure adopted in practice is 80 lb. per sq. in. (gauge), though ejectors can be designed for lower pressures. The air is entrained by friction, and the amount that can be entrained depends on the kinetic energy of the steam. Given the operating steam pressure and the quantity of steam to be used or the weight of air to be extracted, the necessary calculations, of which examples are given in the paper, present no difficulty, ample data being available for the use of the designer. The angle of taper for all the steam nozzles used in these pumps is six degrees, and for the diffusers from 3 to 10 degrees, being determined in the latter case by experiment.

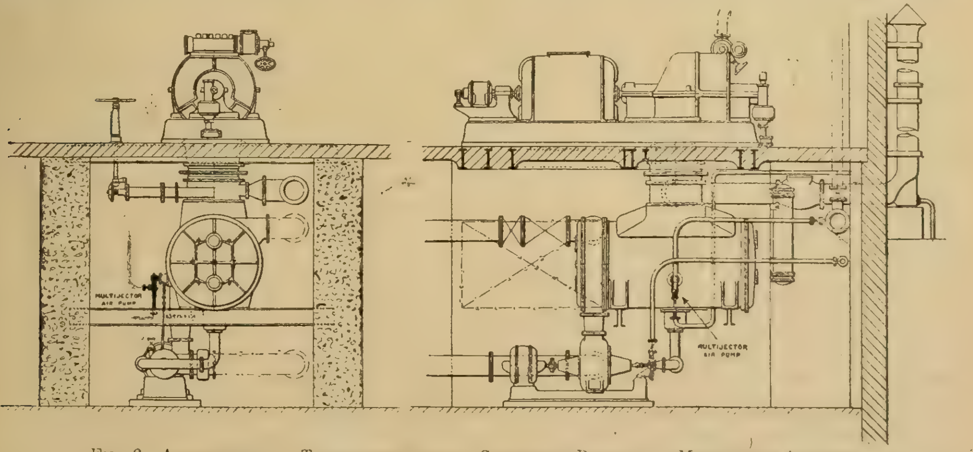

Fig. 2.—Arrangement of Turbo-generator and Condensing Plant with Multijector Air-pump.

In the case of the ejector here illustrated, the total quantity of steam used equals 865.4 lb. per hour. The net heat expenditure in the pump equals 35,277 B.TH.U. This pump would deal with 33, 48, 60, and 80 lb. of air per hour at 95, 93, 91, and 88 per cent. of the theoretical vacuum respectively.

The calculations relating to steam nozzles are exactly in accordance with well-known and established laws, and similar to calculations used in the design of turbine nozzles. It is seldom required to make any changes on these nozzles when testing an ejector. The design of the diffuser is a more complex question than that of the steam nozzle. In the diffuser both steam and air are being dealt with, flowing at different velocities and in a state of aggregation varying at each instant. It is essential to have the steam nozzles machined accurately; if this is not done the amount of operating steam will exceed the calculated figure, and the overall efficiency of the pump will suffer. The high velocities engendered in this type of pump account for the small bulk of the apparatus; and since there are no moving parts, high velocities of the operating steam, and fluid drawn from the condenser or other vessel being evacuated, are not objectionable.

Care must be taken to fix the nozzles in the nozzle plate at such an angle that the steam is directed well into the diffuser, and that the nozzles are placed at a proper distance from the throat of the diffuser. The latter has an important effect on the air-dealing capacity of the apparatus. If it is desired to deal with a large quantity of air at a comparatively low vacuum, it will be found that by placing the nozzles farther away from the diffuser the pump will deal with a greater quantity of air than if they are placed close up to the diffuser entrance.

No useful purpose is served by supplying an ejector with superheated steam. Nevertheless, wet steam is not good for the efficient working of the ejector, and a small amount of superheat is always preferred.

In order to obtain the best results, the heat contained in the steam and air leaving the pump must be utilised, and the common practice is to use it to heat the boiler feed water. If due care is paid to the recuperation of this heat energy, it will be difficult to find a more efficient air-pump.

Certain slots, or holes, are placed on the second-stage diffuser and communicate with the atmosphere. If the ejector is working at a low vacuum and dealing with a large quantity of air, these holes are unnecessary; but if a high vacuum is desired, and the quantity of air being dealt with is small, such connections serve a useful purpose by admitting a certain volume of air from the atmosphere to fill the space in the diffuser, and thus prevent the formation of eddies which would occur were the holes not there. The amount of air thus admitted, if any, is automatically regulated by the space available in the diffuser, and does not require a valve of any kind.

The apparatus illustrated in fig. 1 represents a complete Mirrlees-Leblanc multijector dry air pump. In an ideal installation the work involved in putting the plant into commission is a minimum, as it would only be necessary to make three ordinary pipe joints—one connecting the pump to the vessel to be evacuated, one to the steam supply pipe, and a third to the discharge pipe. Such installations are, however, exceptional. The pump can be placed in any convenient position, which is never a difficult proposition when the small space required is taken into consideration.

The discharge from the pump should, if possible, be led to a feed heater arranged to allow the air contained in the discharge to escape to the atmosphere while the condensed steam drains away to the feed tank, where it can be utilised as a make-up supply for the boilers.

If the operating steam supply is at very high pressure, or liable to variation, it is advisable to use a reducing valve on the steam inlet pipe range, designed in such a manner as to maintain a constant pressure on the ejector side of the valve.

The steam strainers should occasionally be taken out and cleaned with paraffin, or other agent, and it is advisable to keep a spare strainer cleaned and ready to be put in at any time. As the pump can be overhauled and put together again in three or four hours, and as there are no moving parts whatsoever, the working expenses are practically nil. There is nothing on the pump that can wear out and require replacing.

Two installations are at work in the Greenock Corporation electricity department, in conjunction with two 5,000-KW. Westinghouse turbo-alternators. They are able to obtain the maximum vacuum and go on to full load in five minutes.

The chief application of this apparatus is in conjunction with the various types of condensing plant, and up to the present time the number of installations fitted, or under construction, represents about 500,000 KW., or, expressed in pounds of steam condensed per hour, equals 9,000,000 lb. approximately.

Generally in all surface condensers for modern requirements a high degree of vacuum is necessary, and a comparatively small quantity of air has to be dealt with, which makes it possible to use an ejector absorbing only a small amount of heat, thus adding considerably to the overall efficiency of the plant. For jet barometric and evaporative condensers the same high degree of vacuum can be maintained, but naturally the air-dealing capacity for the same steam duty as a surface condenser has to be increased to deal with the extra quantity of air brought into the system with the injection water in jet and barometric condensers, and at the joints in evaporative condensers. In order to reduce the size to a minimum, an intercooler is sometimes used, and by this means the temperature, and consequently the volume of the air, is rendered as low as possible.

There are numerous existing installations working with inefficient air pumps and low vacua where it would be a very easy matter to install a multijector and effect a considerable saving in the annual coal bill. Whether this would be done best by scrapping the old pumps altogether or fitting a small ejector to act as a vacuum augmentor would depend entirely on the prevailing conditions, and each particular case would require special investigation.

Fig. 2 shows diagrammatically a typical condenser installation fitted with multijector air pumps for a surface plant for nd service.

THE APPLICATION OF ELECTRICITY TO VARIOUS AUXILIARIES ON SHIPBOARD.

The following is an abstract of a paper by Mr. H. L. Hibbard read before the Society of Naval Architects and Marine Engineers, New York:—

The marine engineer and the seafaring man in general are naturally conservative in the adoption of new and untried apparatus. The time is rapidly approaching, however, if not already here, when the results obtained will justify the construction generally of vessels electrically equipped in all or many of their power applications.

Two or three years ago, the *Christian X* created much interest on its first voyage with its oil-propelled engines and electrically-operated auxiliaries. The *Chile*, constructed by Burmeister & Wain, of 13,400 tons displacement, and provided with oil engines of 3,000 H.P., was equipped throughout with electrically-operated auxiliaries, both for engine-room and deck machinery. Three Diesel engine-driven, 60-KW. generators furnished direct current to the auxiliaries at 220 volts; one of these sets was sufficient to supply auxiliary power while at sea, and two were used while handling cargo in port. At least one generating set was, therefore, always available as spare.

In the engine-room equipment were included motor-operated fans, a motor-driven centrifugal, circulating water pumps, bilge and sanitary pumps, ballast pumps, engine-turning motor, motor for operating tools in repair shop, &c. In the deck equipment, electrically-operated steering gear, deck winches, and anchor windlass were provided.

As far as we have been able to ascertain, the result of the operation of these equipments has been in every way satisfactory on this vessel, and an interesting article as to the general performance of the vessel was contained in the February issue of *Motorship*. In a visit to this vessel the writer noted the construction and distribution of the electrical equipment, and although it was perhaps somewhat clumsy in design, the engineers in charge appeared well pleased with its performance, and had encountered no particular difficulties.

An article appearing in the March issue of *Motorship* by Mr. G. E. Smith, chief engineer of the American Engineering Co., reviews this situation, and makes the significant remark that "the writer is firmly of the opinion that within a very short time all auxiliaries on motor ships will be electrically driven."

At last year's meeting of the Society, a paper by Mr Frear was presented, covering a description and results obtained from the oil tanker *La Brea*, which was apparently the first instance of electrically-operated cargo pumps on a tank ship, and, as indicated in Mr. Frear's paper, the results were very gratifying, particularly when compared to her sister ship, the *Los Angeles*, equipped with reciprocating engines and steam pumps in contrast with the geared steam turbine and electrical pumps on the *La Brea*.

Among the most striking examples of the use of electricity on merchant vessels are the boats being constructed and projected by the Pennsylvania Shipbuilding Co., New Jersey. This company has under construction six tank steamers of about 7,500 tons displacement, which will be propelled by geared steam turbines, and their auxiliaries operated by electricity throughout. The electrical equipment on each of these vessels will consist of the following:—

Two 100-KW., 3-phase, 60-cycle, 220-volt steam turbo-generating sets; one anchor windlass, 25-H.P. slip-ring type motor; one forced draught fan, 25-H.P. slip-ring type motor; one steering gear equipment, 15-H.P. squirrel-cage type motor; two cargo oil pumps, 80-H.P. squirrel-cage motors, 3-speed, pole changing; two deck winches, 15-H.P. squirrel-cage type motors; one warping winch, 15-H.P. squirrel-cage type motor; one oil transfer pump, 5-H.P. squirrel-cage type motor; one forward bilge pump, 5-H.P. squirrel-cage type motor; one bilge pump for pump room, 5-H.P. squirrel-cage type motor; one circulating water pump, 5-H.P. squirrel-cage type motor; one workshop motor, 5-H.P. squirrel-cage type; one refrigerating plant, 5-H.P. squirrel-cage type motor; one oil tank ventilation blower, 5-H.P. squirrel-cage type motor; one fresh water pump, 5-H.P. squirrel-cage type motor.

In addition to the above tankers, two cargo vessels of 12,000 tons displacement will soon be laid down, each of which will have an equipment of auxiliary motors similar to the above tank vessels with the exception of the deck winches, which will consist of three of 25 H.P. and eight of 15 H.P. It is further contemplated that these two cargo vessels will be electrically propelled and operated by two turbo-generating sets, each set furnishing current to a 1,500-H.P. motor, the two motors being geared to the single propeller shaft.

In addition to these vessels, this company contemplates the construction also of six cargo boats propelled by geared steam turbines, and with electrical auxiliaries similar to the above.

For the above vessels open-type alternating current motors will be provided throughout, and watertight enclosing cases furnished for the deck motors, with the particular view of protecting them from exposure to moisture; but the cases can be removed, if desired, when the vessels are in port, to give the motors ample ventilation.

The majority of the motors will be operated from a common switchboard in the generator room, and in most cases no means is provided for starting or stopping the motors at the auxiliary. A particular exception is the case of the anchor windlass, which has its controller near the motor on deck.

It will be noted that alternating current has been employed throughout on the above vessels, and those advocating the same point to the necessity, in the case of the tank vessels, of using the alternating current squirrel-cage type motor, with its freedom from moving contacts in places exposed to the possible presence of oil vapour. With the same object, the controlling devices, as described above, are all centralised in the generator room. On these vessels also an interesting form of deck winch is used for the first time, employing a constant running motor and a set of planetary gears, so arranged that, by the operation of a lever and two brake bands, the load can be stopped or the speed of the winch varied while the motor continues to operate at constant speed.

In contrast to the alternating current used on the above vessels, the Texas Oil Co. is soon to construct a tank vessel of approximately 6,000 tons displacement, propelled by fuel-oil engines, and provided with direct-current, 230-volt motors on its auxiliaries. The principal auxiliary equipments on this vessel will be as follows, although a few additional items will probably be eventually supplied:—

Six 30-H.P. variable speed cargo pump motors, enclosed type, variable speed; one 20-H.P. fire-room bilge pump motor, enclosed type, constant speed; four 5-H.P. constant speed enclosed type motors for operating auxiliary pumps; two refrigerating machines, 3-H.P. enclosed type motors, variable speed; one 10-H.P. steering gear motor, open type, constant speed; two cargo deck winches, 20-H.P. enclosed type, compound wound; one 20-H.P. capstan, open type, compound wound; one 25-H.P. windlass, enclosed type, compound wound.

The six cargo pump motors and the bilge pump motor, all we understand located in the same compartment, will be operated from controllers on a common switchboard in the generator room, similar to the arrangement for the Pennsylvania Shipbuilding Co.'s tankers. In addition, however, watertight push-button stations will be located adjacent to the motors, which will stop the pumps when desired, to be again started from the generator room. The cargo pump motors and the motors exposed on deck will be probably provided with enclosing cases, furnished with forced ventilation, or this forced ventilation will be carried directly into the enclosed motor frames.

In addition to the two cargo vessels at the Pennsylvania Shipbuilding Co.'s plant, which it is intended to propel electrically, we are familiar with electrical installations on four oil barges under construction at New Orleans by the Petroleum Transport Co. These boats are twin screw, each propeller being driven by a 300-H.P., 480-volt, 3-phase, 60-cycle motor, the two motors being operated by one turbo-generating set of similar voltage and frequency. These motors are operated by automatic contactor controllers from a common master station, two control levers giving straight-line motion similar to the valve levers of the usual reciprocating engine installation.

While the geared steam turbine has shown some excellent results and the use of the heavy oil engine for propulsion purposes will probably be extended, a combination which may receive a good deal of consideration in the future in this connection, especially for equipments of average size, is the operation of one or two generating sets by oil engines instead of steam turbines, the generators to operate the propelling motors as at present. Such an arrangement provides the advantages of the use of fuel oil, at the same time retaining the flexibility of the electrical drive and permitting oil engines to be used without reversing features.

The progress made is noteworthy, especially in view of the opposition which has been encountered by the use of electricity until recently from many of the steamship companies, shipyards, and manufacturers of steam apparatus.

Numerous specific advantages are apparent in connection with such installations in the merchant marine, including frequently a saving in space and weight in the installation of the auxiliaries themselves, a very much higher efficiency of operation, and consequent saving in total fuel consumption, the elimination of long and objectionable lines of steam piping, which on certain classes of cargo vessels are nearly always installed above deck, and result in continual steam condensation; also, on certain of the auxiliaries, particularly those requiring varying speed and load conditions, the electric motor offers some distinct advantages over the use of the steam engine.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Vertical-Spindle Induction Motors.

We have recently received from the British Thomson-Houston Co., Ltd., Rugby, list No. 2,180 of vertical-spindle induction motors, these machines being specially built for vertical direct connected driving where two or three-phase A.C. is available.

These vertical induction motors are supplied in all sizes from 2½ to 450 H.P., and consist of a stator suitably designed for the speed and supply circuit, and a rotor of either squirrel-cage or slip-ring type.

The latter type of machine has its advantages in starting under load with reasonable current, and permits of speed variation by the insertion of resistance in the rotor circuit.

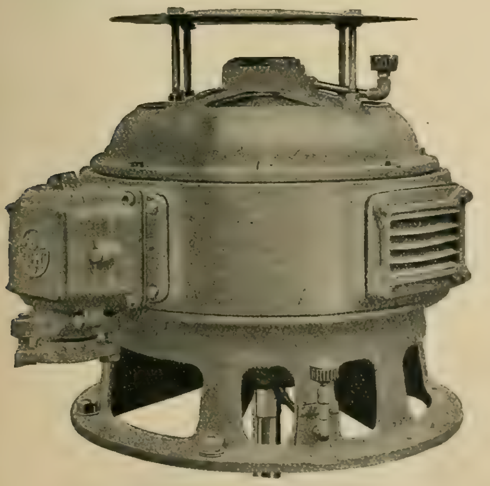

Fig. 1.—B.T.H. 30-H.P., Drip-proof Vertical Induction Motor.

The squirrel-cage motor, on account of its simplicity and absolutely sparkless operation is specially suited to certain industries and situations, especially where a possibly heavy starting current is not open to objection. On account of the latter feature it is generally used for small powers, but a starting device can be used to prevent the rush of current at starting, at the expense, however, of the starting torque.

Standard machines for two or three-phase, 40, 50, or 60-cycle circuits, are supplied for pressures between 95 and 550 volts. These machines are rated at 40° C. temperature rise under continuous full-load conditions, and embody the well-known features of B.T.H. construction; they are reversible by interchanging the stator leads, and the three-phase machines can be supplied with three or six terminals, the latter for use with star-delta starters, while the two-phase machines similarly can be provided with four or eight terminals, the latter for use with series-parallel starters.

Full particulars are given of H.P., speed type, &c., of all these motors.

A Method of Banding an Armature.

The accompanying illustration shows a method of banding armatures that does away with the old scheme of using two pieces of fibre as a clamp or twisting the band of wire around a nail to draw it tight enough, which necessitates the completion of a band when once started, and further obviates the removal of a band should it not be sufficiently tight. It will also be found that should the coils project above the core in the banding space, they can be gradually pressed down without driving with a hammer and fibre wedge, thus eliminating one of the frequent causes of short-circuits when the coils are very tight.

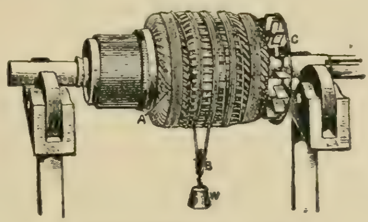

Fig. 2.—Banding an Armature.

To use this method, fasten one end of the banding wire to a coil at one end of the winding at A, and lay the band on hand tight in one piece; then pass the finishing end of the banding wire through the pulley B, and fasten it to the winding at the other end of the armature, as shown at C. Attach a weight W to the pulley, according to how tight the band is required, and turn the armature. When the armature is turned, no matter how fast, the banding wire will follow in exactly the same place as it was laid by hand, consequently the band must be placed on in the first place perfectly straight. When the weight has travelled to the other end of the armature, if the bands are not satisfactory, turn the armature in the opposite direction, and keep on repeating the operation until tight enough.

This may be repeated as many times as deemed necessary, and more weight may be added as the process is continued, until sufficient pressure is obtained without breaking the banding wire. On account of being thus able to apply a gradual pressure, the coils can be gradually pressed down into the slot, should they be high, with probably the assistance of a very light tapping with hammer and fibre.—R. Thistlewhite, in the *Mechanical World.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Dust Coal.

One of the permanent troubles of the housekeeper is the want of a satisfactory way of burning the dust coal which accumulates in every coal cellar and, in spite of all efforts, invariably increases.

With fuel at its present prices, and stock limited, the matter has become of importance, and it should be worth while to systematically collect it, and, by converting it into briquettes of suitable size, secure its economical consumption.

I have long thought that every coal bunker of importance should be supplied with a small form of briquetting machine, while in many parts of the country such a machine could possibly travel from house to house in much the same way as in France the cider press is moved from house to house of small towns and villages, often operating in the street itself.

I make the suggestion in the hope that it may be possible to devise some such machine at no great cost, and am certain that its use would be advantageous to both the householder and the country generally. There are probably thousands of tons of dust coal in cellars practically wasted.

Perhaps, though, your readers may be able to suggest a new and satisfactory method of burning it without recourse to any such machine. I have tried various ways, and have not found a practical one.

Chile.

December 21st, 1917.

Re Mr. F. L. Rawson.

We understand that a number of people are under the impression that the above is connected with this company, in consequence of a statement made by him at a recent meeting of the I.E.E. referring to his office as "Consulting Engineer to the St. Helens Co."

Will you kindly allow us to clear our name from such a misunderstanding by stating that Mr. Rawson has never had any connection with this company.

We have investigated the matter, and find that the company to which Mr. Rawson referred is one using "St. Helens" as part of its name, and that it claims to obtain gold from sea water.

St. Helens Cable and Rubber Co., Ltd.
H. T. Brooking, *General Manager.*

Warrington, *December 28th*, 1917.

Distinctive Colours for Braided Cables.

Referring to Mr. T. D. Spark's letter on the above subject, in the Electrical Review of the 28th inst., it has been our custom for many years to supply cables having an outside compounding of a third colour, in addition to red and black, where desired. The most convenient colour, and the one which is usually adopted, is white, but other colours, amongst them yellow, could be supplied without difficulty.

W. T. Henley's Telegraph Works Co., Ltd.
J. Bishop, *Manager, Sales Department.*

London, E.C., *December 31st*, 1917.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

18,704. "Sparking plug." E. Lax. December 17th.

18,729. "Electric petrol or fluid gauge." J. Goodley. December 17th.

18,731. "Means for cooling commutators of electrical machines." E. C. R. Marks. (Akt. Ges. Brown, Boveri et Cie.) December 17th.

18,745. "Control mechanism for electrically-propelled vehicles." Industrial Appliances, Ltd., & J. G. Robinson. December 17th.

18,746. "Controllers for motors of electrically-propelled vehicles." Industrial Appliances, Ltd., & J. G. Robinson. December 17th.

18,748. "Machine switching telephone systems." L. Polinkowsky and Western Electric Co. December 17th.

18,750. "Sparking plugs." J. Courtier & P. Courtier. (France, July 12th.) December 17th.

18,753. "Dynamo-electric machines." M. Latour. December 17th.

18,763. "Means for utilising waste heat in electrical machinery, &c." H. F. J. Thompson & T. H. Wood. December 18th.

18,778. "Electric arc lamps." H. S. A. Rydberg. December 18th. (Sweden, November 11th, 1916.)

18,789. "Systems of electric cut-outs." British Thomson-Houston Co. (General Electric Co., U.S.A.) December 18th.

18,796. "Automatic telephone systems." Automatic Electric Co. and Automatic Telephone Manufacturing Co. December 18th.

18,800. "Electrolytic processes." E. A. Cunningham. December 20th.

18,816. "Means of illuminating magnetic compasses, &c." C. F. Ryland December 19th.

18,847. "Cradle for supporting electric cables and their fittings." H. Bades. December 19th.

18,860 & 18,861. "Rotary field magnets." B. Ljungstrom & F. Ljungstrom. December 19th. (Sweden, December 19th, 1916.)

18,876. "Electric arc furnaces." H. Coates & Watford Electric and Manufacturing Co. December 19th.

18,881. "Magnetic liquid compasses." M. B. Field. December 20th

18,890. "Telephone writing tablet or pad-holder." C. W. H. Westell. December 20th.

18,900. "Electrolytic processes." Chance & Hunt, O. E. Mott & T. A. Smith. December 20th.

18,920. "Audion or lamp-relay or amplifying apparatus." M. Latour. December 20th. (France, December 20th, 1916.)

18,923. "Automatic switch for wind-driven electric supply plant." W. P. Perry. December 21st.

18,935. "Magnetic blow-out fuses." G. H. Neep and Switchgear and Cowans, Ltd. December 21st.

18,953. "Electromagnetic clutches." A. Soames & W. Langdon-Davies. December 21st.

18,954. "Insulated electric cables, wires, &c." Callender's Cable and Construction Co., P. M. Bennett & J. F. Watson. December 21st.

18,963. "Dynamo-electric machines, &c." J. F. Poynter. December 21st.

18,976. "Apparatus for transmitting and distributing electrical energy." G. E. Turnbull & A. V. L. Hubert. December 21st.

18,993. "Spring drive for magnetos, &c." G. E. Bradshaw & A.B.C. Motors, Ltd. December 22nd.

18,995. "Sparking plugs." G E. Bradshaw. December 22nd.

19,004. "Trolley guide for electric trams." W. Barratt. December 22nd.

19,011. "Electrical steering of vessels." J. H. Balcombe & T. Dawson. December 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

7,936. Portable Electric Battery. A. Sandrini. June 5th, 1915. (100,643.)

12,168. Insulation of Electric Cables. H. Tietgen. August 28th, 1916. (111,496.)

12,305. Apparatus for Converting or Transforming Electric Currents. K. T. Wang August 30th, 1916. (111,497.)

15,137. Electrolytic Cells. F. G. Wheeler. October 30th, 1915. (102,049.)

17,170. High-frequency Signalling, particularly applicable to Wireless Telephony. Western Electric Co. December 1st, 1915. (102,503.)

17,213. Recording Apparatus. D. B. Morison. November 30th, 1916. (111,531.)

17,453. Boosting in Electric Distributing Systems. H. A. Gill. (U.S. Light & Heat Corporation.) December 5th, 1916. (111,543.)

17,454. Dynamo-electric Machines. H. A. Gill. (U.S. Light & Heat Corporation.) December 5th, 1916. (111,544.)

17,681. Dynamo-electric Machines. British ThomsonHouston Co. (General Electric Co., U.S.A.) December 8th, 1916. (111,551.)

17,702. Electric Ovens, Hot Cupboards, and the like. J. S. Langford. January 14th, 1916. (103,476.)

17,820. Electromagnet for Lifting Materials. A. D. Riviere and Soc. Centrale d'Enterprises A. D. Riviere et Cie. December 11th, 1916. (111,554.)

17,872. Rotary Distributors, particularly for use in the Ignition of Internal-combustion Engines. Etablissements de Dion-Bouton Soc. Anon. January 26th, 1916. (103,817.)

18,323. Manufacture of Filaments for Incandescent Electric Lamps. Westinghouse Metal Filament Lamp Co. (Westinghouse Lamp Co., U.S.A.) December 21st, 1916. (111,569.)

18,398. X-ray Apparatus. G. R. Hogan & H. P. MacLagan. December 22nd, 1916. (111,570.)

1917.

255 Process of Electric Welding. T. E. Murray. February 18th, 1917. (104,500.)

1,307. Strip-perforating Mechanism for Code Telegraphy. H. H. Harrison and Creed & Co. January 25th, 1917. (111,582.)

1,880. Spark Plugs. C F Arnold. February 7th, 1917. (104,334.)

3,606. Automatic Signals for Railways. R. L. Edwards & H. Edwards. March 12th, 1917. (111,608.)

3,916. Electric Bells. Sterling Telephone & Electric Co., F. G. Bell, and W. C. Davey. March 17th, 1917. (111,609.)

4,637. Interrupter Mechanism for Electric Circuits. O. Mutto. March 30th, 1917. (111,414.)

5,246. Tanks for Electrical Transformers. A. Schaanning & J. L. Thompson. April 13th 1917. (111,621.)

5,301. Control of Dynamo-electric Generators. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.) April 14th, 1917. (111,623.)

5,358. Electrical Insulators. G. V. Twiss & Bullers, Ltd. April 16th, 1917. (111,624.)

5,365. Thermal Electrical Relays and Circuit Controllers. E. A. Graham & W. J. Rickets. April 16th, 1917. (111,420.)

5,644. Lanterns or Casings for Incandescent Electric Lamps. H. T. Wilkinson & Wardle Engineering Co. April 23rd, 1917. (111,629.)

6,374. Starting Apparatus for Motor-car Engines. Akt. Ges. Brown, Boveri, et Cie. May 29th, 1916. (106,820.)

9,108. Electric Signalling Devices. J. Atherton. June 25th, 1917. (111,640.)

9,165. Electro-pneumatic Brake System. W. V. Turner. December 6th, 1916. (111,439.)

9,294. Engine Starter. V. Benedix. June 28th, 1917. (111,440.)

9,470. Electric Switches. A. H. Midgley & C. A. Vandervell & Co. June 30th, 1917. (111,258.)

9,962. Telephone Exchange System. Western Electric Co. (Western Electric Co., U.S.A.) July 10th, 1917. (111,261.)

10,129. Electric Batteries. Edison Swan Electric Co. & S. S. Bird. July 12th, 1917. (111,444.)

10,162. Mine Signalling Apparatus. J. Milligan. July 13th, 1917. (111,642.)

10,423. Cord Grips for Electric Conductors. C. G. M. Bennett. July 19th, 1917. (111,447.)

11,226. Electric Motor Control Systems. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.) August 3rd, 1917. (111,265.)

11,420. Ignition Devices for Internal-combustion Engines. W. O. Kennington. August 8th, 1917. (111,644.)

13,073. Wireless Telegraphy and Telephony. Western Electric Co. (Western Electric Co., U.S.A.) September 12th, 1917. (Addition to 102,503.) (111,649.)

14,369. Electric Motors. H. L. Tanner. July 19th, 1917. (Divided application on 15,363/16.) (110,359.)

15,901. Shadeholders for Electric Lamps. T. H. A. Brown. October 31st, 1917. (111,653.)

German Proposals for State Generation and Distribution.—A brochure on the "Form and Aims of a National Electricity Supply," written by Ludwig Aschoff, has recently been published in Berlin. The author outlines a far-reaching scheme of nationalisation for electricity generation and distribution, and considers it desirable that this fresh source of Imperial revenue should be tapped forthwith; "the immediate unification of public electricity supply is most desirable on political, social, and financial grounds." Both generation and distribution are embraced by the author's proposals, which are that generation should be taken over by the State and distribution by the provinces. Independent current supply in individual communities would be permitted by State concession in special cases only. Administration and operation would be on a broad and efficient commercial and scientific basis. A national Electricity Board would deal with matters concerning the State and provincial authorities and local Councils would be appointed to represent current consumers in each province. One of the primary duties of the National Board would be to regulate tariffs so as to secure a suitable net surplus and then to apportion the latter between the authorities concerned. Obviously, this scheme goes a good deal further than projects for the nationalisation of generating stations alone, as has been contemplated by several publicists.

Aschoff estimates that complete unification of public electricity supply in Prussia on the above lines, without raising the present prices for energy and without levying a tax, would yield about £8,000,000 net revenue, say 10 years hence, on an estimated ouput of 17,000 million units (compared with not quite £1,000,000 on 2,100 million units in 1913 and 1914-15). It is not possible at present to discuss the author's estimates in detail, but, as remarked by the *Bulletin* of the Association Suisse des Electriciens, it would have been more to the point to have compared receipts, expenses, net profit, and working conditions for, say, 1913 under (*a*) the present sub-divided system of generation and distribution; and (*b*) unified working such as is proposed by the author. A comparison of this sort would be more definite and more capable of discussion than one involving the probable state of electricity supply in the period 1926—1930.

Entertainment.—On December 27th, the Blackpool Tramways & Electricity Employés' Institute entertained the wives and families of employés on active service to a concert, tea, and Christmas tree in the Winter Gardens. About 300, principally children, were present.

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THE REPORT OF THE COAL CONSERVATION SUB-COMMITTEE.

WE dealt at some length, in our leader of last week, with the general aspect of the far-reaching proposals contained in the above report. Needless to add, the carrying-out of these proposals will necessitate the practical solution of many technical questions of a highly controversial character, and, as is almost inevitable in such cases, we shall probably arrive at a compromise, of a more or less acceptable nature, but representing something very different from the picture which one might conjure up in imagination after a perusal of the report. The Sub-Committee, in its desire to emphasise the ideal, has, perhaps intentionally, glossed over the technical and financial features of its scheme, which, however desirable, will not appeal to the engineer unless its practicability can be demonstrated.

Many of the recommendations contained in the report may be assumed to be based on experience gained by the North-East Coast Power Companies, and, without detracting in any way from the excellent work carried out in that super-electrical area, one may question whether the conditions obtaining there can be reproduced in more than one or two other areas. The Tyneside district certainly offers a specific example of unified control on a large scale of a number of interlinked generating stations, the two largest of which, however, fall considerably short of the size of super-station defined in the report, and this despite the intensive electrical development of the area, in which some 350,000 H.P. is connected to the system.

Admitting, however, that we shall of necessity concentrate our generating capacity in large-unit plants, the question of sites for the latter arises. Every engineer will agree with the desirability of building these large stations on important waterways, as suggested in the report, in order to obtain adequate condensing facilities, if the additional cost of coal transport and electrical transmission does not render that course impracticable. Several of our leading municipal undertakings have made arrangements to erect large generating stations—of the order of 100,000 KW. or more—and as regards those situated inland and adjacent to colliery districts, the question resolves itself into the relative cost on the one hand of transmitting 100,000 KW. over a distance of, say, 20 to 40 miles, from the nearest suitable waterway, or, on the other, of artificially cooling the condensing water on the inland site. In any case, inland waterways of the size required for the type of super-station indicated in the report are few and far between, while in some instances their use would involve considerably increased coal transport—an important matter where the annual tonnage runs over the hundred thousand —as well as extra transmission cost.

It has to be remembered that the modern power station has been a product of evolution; the all-big-unit plant has only become possible where it is projected, because the load conditions have been suitable; and as super-stations of any kind cannot profitably be brought into use until the necessary load is available—and existing turbine stations are unlikely to disappear until their operating performance can be bettered—it is evident that the general use of such big stations will be a question of time and circumstances, on which the financial questions involved will have an important bearing.

The report is somewhat obscure on these points, as we gather (*a*) that "the linking-up of adjacent power stations should be encouraged," as a step in the direction of greater economy, provided it is appreciated that it is only a step; (*b*) that the proposed electricity commissioners should at once make "arrangements" for the generation of power on a large scale, preferably from super-stations; and (*c*) that plans should be prepared for the construction "immediately after the war" of the first instalment of large super-power plants.

Apart from the question of providing acceptable controlling bodies for the proposed areas of supply, the necessity of dealing firmly with the programme of future construction appears to be one of the most pressing matters of the moment.

Exception will doubtless be taken, in municipal circles, to the comparison of average prices charged by electrical authorities in the Lancashire area with the average price obtaining on the North-East Coast system. The figures for private and total supply are misleading, because the proportion of domestic and small power users to the total is far greater in the general run of local undertakings than in the case of the North-East Coast area, where bulk supplies preponderate; on the other hand, it is precisely this preponderance of bulk supply which gives us a true indication of the fuel economy in the area, with which, of course, the Sub-Committee is primarily concerned. It will be noted, however, that some Lancashire towns (Stockport .8d., Bury .72d., Ashton .85d., Stalybridge .66d.), despite their comparatively small areas and outputs, supply at prices which, all things considered, bear comparison with those on the North-East Coast, and doubtless from the same cause, *i.e.*, the great preponderance of power supplies in large blocks.

Too much importance must not be attached to these isolated examples of low average total cost; the North-East Coast prices evidently work out at a still lower average for industrial purposes, and that over a very large area, which is of greater importance to the welfare of the electrical industry as a whole than low prices in individual localities.

The estimates of fuel saving in the report are based on the assumption that on the average 5 lb. of coal is consumed per H.P.-hour at the present time. On the North-East Coast it was found that an average of 7 lb. had been used, but colliery areas are notoriously wasteful of fuel, and in the textile districts of Lancashire and Yorkshire, which are probably the largest power consumers in the country, it seems probable that considerably under 5 lb. per H.P.-hour is used. The Bradford city electrical engineer has, in fact, given figures which he has obtained from 18 different textile works covering the staple trades of the district, and using over 28,000 I.H.P., which show an average coal consumption of only 2½ lb. per H.P.-tour. These figures are presumably obtained from large installations, and the question will naturally be asked whether they are representative of the textile districts as a whole. To put the matter in another way, is the Sub-Committee justified in basing its estimates for the whole country on an average of 5 lb. of coal per H.P.-hour, when what was probably one of the most wasteful districts only required an average of 7 lb.?

One of the most important factors in the development of electric power supply on the gigantic scale contemplated by the Sub-Committee is the question of wayleaves, to which we have repeatedly drawn attention in these columns. The provision of statutory facilities for carrying overhead lines across country is an absolute *sine qua non* to the success of the scheme, particularly in the case of trunk lines operating at pressures of the order of 50,000 or 100,000 volts, which will be necessary if the generating stations are situated at a considerable distance from the areas where the supply will be utilised. Whether such a line be erected on a special right-of-way acquired for the purpose, as in the United States, or carried across land in private ownership, the difficulties of which Mr. Vernier gave such striking examples in his paper before the I.E.E., will present insuperable obstacles without the intervention of the Legislature. Even if the Sub-Committee's proposals had not been put forward, the solution of this problem would have remained of vital importance to the electricity supply industry. We are told by Dr. Addison in a prefatory note to the Report that the legislative aspects of the whole matter are being investigated by the Board of Trade Committee on Electric Power Supply, and we trust that no effort will be spared by the leaders of the industry to impress upon the Committee the extreme urgency of this question, which is essentially one that can be adequately dealt with only by *ad hoc* legislation.

Electric Motors in Germany.

Some time ago we referred to the introduction of compulsory notification by makers and owners of dynamos and motors in Germany, with the object of their being requisitioned by the military authorities as occasion might arise. Now a fresh notice has just been issued, intimating that inquiries have resulted in the discovery that many motors which ought to have been reported have been withheld by the owners, possibly in ignorance of the order issued in June last.

The notice lays emphasis on the fact that a return must now be made of all motors of an output of 2 H.P. and upwards, excepting those which are used in establishments engaged on war work, and those used for the operation of lifts which are in regular service. If advantage is not taken of the present opportunity, those persons who neglect to make a return are threatened with the legal penalties provided under the law, in the event of further inquiries resulting in the finding of non-reported motors. It would appear from these circumstances that the comparative scarcity of copper, in face of the great demand, is reaching a stage when the dismantling of motors will have to be taken in hand, although it has to be borne in mind that the peace-time copper production of Germany was approximately 42,000 tons per annum.

REMINISCENCES.—II.

By "EX-SHIFT DOG."

"Experience teaches," so the proverb avers, and frequently mistakes in operation call attention to deficiencies in design or equipment, and cause alterations which not only prevent the repetition of the mistake, but tend to promote more reliable running thereafter. But also experience wrongly understood causes much trouble, and it is necessary thoroughly to grasp the whole circumstances of the case before arguing general principles from a particular experience. A certain station used pumice-stone freely and satisfactorily for polishing the commutators of both reciprocating and turbo-generators, and, misled by this, the writer applied carborundum stone in like manner to the surface of a direct-coupled turbo-exciter, with the result that the sparking and vibration it was hoped to cure were made very much worse. The harder abrasive was successful eventually, however, when it was guided firmly and used after the manner of a lathe tool to take out the irregularities of the surface. In this connection it is a practical tip of some importance in the running of turbo-generators to grind up exciter commutators at working speed, or rather over, as turning-up in a lathe is seldom quite satisfactory. High-speed commutators should be made true under working conditions of speed and support.

The usual power-station plant produces a considerable amount of noise, and therefore visual signals are often employed instead of, or auxiliary to, acoustic ones. The process of calling the Chief by means of a messenger is rather antiquated, and a system of bells or coloured lights in and around the station can, by means of a simple code, be made useful for this service and for others of a like nature. Telephone call-bells are also sometimes reinforced by coloured lights in prominent positions; but the most original use of visual signals with which the writer is acquainted was in connection with a system of circulating water pipes. The layout of the plant and its development had brought the circulating system into a rather complicated state; there were a large number of valves spread over a considerable area, and also alternative suctions. A mistake occurred whereby a condenser suction was opened on to a cooling pond and forgotten, while the delivery returned elsewhere. The pond was quickly drained dry, of course, and the incident resulted in the following convention:—A certain arrangement of valves was adopted as being "normal," and the valve key was then deposited in a rack in the engine room. Any alteration made to the circulating system necessitated the use of the valve key, and the key was allowed to remain on one of the affected valves until a return to "normal" conditions was made. The absence of the weight of the key in its special rack allowed a relay to close a circuit whereby a red light was lit in a prominent position, so that there was no excuse for forgetfulness of the state of the circulating system.

At another station the circulating water was entirely cooled by towers, and the routine procedure was to drain off about a foot depth of water from each tower per day in order to keep down the concentration. Several times the drains have been opened and forgotten, resulting in loss of circulating water and vacuum; and it may be useful to note in this connection that it is not necessary for the water level to reach that of the suction, for vortices may be formed some time before then, and a momentary gulp of air entrained with the water may easily cause a centrifugal pump to drop its suction. In one case in which a loss of circulating water occurred, the generating unit was allowed to continue running exhausting to atmosphere, and as there was no foot valve fitted to the water suction nor steam inlet valve to the condenser, the latter became very hot. When the tower pond had refilled sufficiently, the circulating pump was restarted, with the result that the end doors of the condenser were cracked asunder, and a certain amount of damage was done to the tubes. Afterwards a non-return valve was fitted to the suction, and a town's water supply provided for flooding the condenser water space if necessary. Another case of lost water was due to a violent gale, which, impinging at just the right angle upon towers standing in an exposed spot, literally blew all the water out of them. These towers during one hard winter became so thickly coated with icicles that the air inlet at the bottom was very restricted, and the cooling efficiency fell off to a remarkable extent before the cause was discovered; it took several labourers some hours to clear it and so restore normal low temperatures. Wet air filters as often fitted to turbo-alternators are very liable to become similarly frozen up, and, in fact, in really cold weather it has been found impossible to keep these running, in spite of steam heating coils and a temperature of spray water as high as 55° F. The great danger is that if the eliminator plates become anything approaching solid with ice the suction of the generator rotor will pull the water in the trough through in its liquid state, a proceeding not calculated to increase the insulation resistance of the stator and rotor windings. A certain 3,000 R.P.M., 2,000-volt, 3,000-KW. alternator of Swiss design and construction has been swamped twice in this way with no serious results, and is—like the aunt of our youth—still running.

Frost, too, has been known to interfere with the supply of make-up water for boiler feeding purposes, and this is an important point to watch in severe weather. An undertaking in which there are employed a number of large water-cooled transformers achieves two results by sending its make-up supply first around these cooler coils and around the oil coolers and bearing systems of the large turbo units, before admitting it to the feed tank; it thus conserves heat units usually wasted, and prevents any danger of storage tanks freezing.

A battery of insufficient size in a small station is a delusion and a snare. The temptation to shut down all prime movers at times of light load is irresistible, and probably that proceeding is justifiable in the early days of a station, or where the load is entirely lighting, and therefore easy to foretell; on the other hand, in a lighting station the heavy top loads necessitate heavy feeder fuses or breaker settings, which are out of proportion to the capacity of the battery when it alone is supplying the bars. To prevent a fault interrupting the whole supply under these latter circumstances, it is necessary to substitute small feeder fuses, whenever entirely depending upon the battery. In a very small station this was regularly done, but on one occasion it transpired that during running hours a fault on a large installation had blown its consumers' fuses. The contractor called in was a man of resource, and, failing to find the fault immediately by usual methods, proceeded to blow fuses galore upon it, in the expectation of smelling it out, apparently. However, in the meantime at the station the small feeder fuses were inserted, and the plant shut down upon the battery. The brainy contractor located his fault at length, but the station engineer was horrified to find, upon his return from a plant repair job remote from the switchboard, that the entire town's supply was being maintained through one remaining feeder fuse, and that one was cherry red! The feeders were interconnected by the distributors, of course, but probably one more attempt by that enterprising contractor would have meant total interruption of supply.

With heavy loadings or H.T. A.C., fuses are not now used, of course, for feeders or other purposes; breakers in the case of D.C. and auto oil switches for A.C. having taken their places. Reverse current breakers are very useful in D.C. stations of decent size, for isolating the battery and works power from the main bars. In a large mixed D.C. and A.C. station all auxiliaries were D.C. motor driven, while the battery was of such a size as to be useless for dealing with even one of the outgoing feeders. The battery and works auxiliaries were therefore isolated on to special bars, and arrangements made that certain sets could also be connected, if required. These bars were then coupled to the main bars by means of a reverse current breaker. Normally, the works power flowed through this breaker, and one could even discharge the battery, and so relieve the system of a part of the works demand, if desired; but in the event of a heavy short or a D.C. shut-down, the battery, attempting to supply the main bars, would thereby isolate itself on to the works auxiliaries, and so safeguard their supply and facilitate recovery. Previously there was but little D.C. trouble, and this arrangement was generally considered somewhat unnecessary, but, within about three weeks of its being fitted, the device saved the station no fewer than five times, and was thenceforth regarded as an excellent idea. So does experience modify conclusions.

A.C. oil switches are usually more or less remote controlled, either electrically or mechanically, and their operating coils and plungers, or relays, are fitted on the switchboard face. Relays ought to be self re-setting, especially for substation use, although time-limit fuses are not considered objectionable. A heavy short once brought out all the interconnecting switches between two stations, including several in sub-stations. One station happened to be shut down, and had only banked fires—it was night and the minimum load period. The other replaced one feeder, but the second was faulty. The sound feeder had opened also at a sub-station, and the attendant attempted to replace it without first re-setting the relay. He was unused to the gear, and it took 20 minutes to make him understand by telephone what to do. A demand of about 1,200 KW. had to wait for those 20 minutes.

Isolating links should be near the switches or apparatus isolated, or, at any rate, in the same compartment. If unavoidably in a remote situation, the guard screens of the apparatus and of the isolators should be interlocked. A concrete example of the necessity for this may be cited. A power station's outgoing feeders (E.H.T.) are arranged in duplicate upon the "distribution-house" system, so that one feeder of each pair is taken from one side of the house; in this way, by paralleling the duplicate feeders outside and isolating, quite a considerable number of switches and quantity of bus-bar gear can be made dead for cleaning and repairs. The station transformers were fed from either or both sides of the "house," and could be coupled as required by isolating links in their vicinity and remote from their switches. One side of the "dis-house," as it is usually and colloquially termed, was made dead in order to carry out some alterations, and that particular station switch was opened after paralleling by means of the links. The Resident himself was nearly killed through touching some current transformers which were alive by feeding back from the opposite feeder switch, *viâ* the links. This experience resulted in labels being placed upon the screens of these cubicles, warning operators to be sure of the positions of the station links before commencing work; but this precaution was not sufficient to prevent a repetition of the affair under slightly different circumstances. At a later date the feeders were paralleled outside and one side of the "dis-house" was made dead for some cause, and the charge engineer, being called away from another job for the purpose, proceeded to "flash" the bars before attaching the temporary earth leads which were always in use while work was in progress on any E.H.T. gear. This was done by making fast one end of a stout piece of cable to a good earth, and touching all bars within reach with the other end. To the charge engineer's surprise, there was a heavy flash when this was done to some bare leads, and the opposite feeder switch opened violently; then, and only then, did he remember the isolating links in the basement on the outgoing feeders. These had not been opened, and hence the leads were alive up to the switch terminals, feeding back from the opposite side. It should not have been possible to have opened the screens around the gear until those links had been withdrawn. Luckily, owing to the care taken in "flashing," no one was hurt and no damage was done except for the interruption of supply on those duplicate feeders. Mental aberration of this sort is difficult to provide against, but every effort should be made to have simple interlocks where, as in this case, they are obviously called for. Familiarity, of course, tends to breed carelessness, if not quite contempt, although in the old days of screwed plug-bars the writer has often investigated the temperature of these plugs with the naked hand on a 3,300-volt system, using no other insulation than that provided by standing upon an ordinary wooden chair.

Electrochemistry in South Africa.—New works for the production of carbide and electric carbons on a large scale have been established at Germiston, South Africa.

SOME CONSIDERATIONS ON THE BRITISH ELECTRICAL INDUSTRY AFTER THE WAR.

By E. S. HODGSON.

Most electrical manufacturing concerns are probably too occupied on war orders at present to give much attention to the development of trade on the conclusion of peace. Yet the question is one that must be tackled vigorously now, or just as soon as the influx of urgent war work diminishes. There is evidence from some sections of the German technical Press that the Germans have this matter well to the fore. They realise that considerable difficulty will be experienced in regaining the fortunate position they held previously, owing to the progress made by British manufacturers and the speeding-up methods which the Americans have adopted as the result of their entry into the world conflict.

The French electrical industry, too, is waking up to the realisation that its manufacturers were left far behind before the war, owing partly to the policy of German penetration, and partly to a certain lack of facilities for higher technical education. That they also will look to the conclusion of peace to give their activities the necessary impetus, there is no doubt. The same, or practically the same, remarks apply to Italy.

It may well be asked whether British electrical manufacturers will be prepared to give serious consideration to the question of combines after the war—a feature to which Germany owes in no small measure the success she attained. At all events, a general selling combine amongst the smaller manufacturers is worth considering. Such combine would be able to employ common representatives in the several European and overseas countries. These representatives should, of course, be men possessing high technical training and undoubted business qualifications. Their business would be to keep well in touch with the authorities in the countries to which they are accredited, report on developments, openings for trade, &c., and to advise promoters of development schemes as to the best plants for their purposes. In this latter connection they could work in consultation with the experts, in order to secure the necessary harmony and close co-operation.

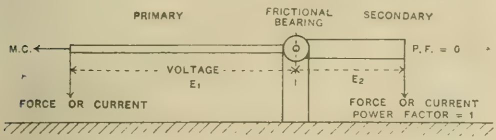
The smaller British concerns—*i.e.*, those who have not travelling representatives in the different countries—would do well to give more attention to the translation of their catalogues into foreign languages, and to the spending of a certain amount on useful propaganda work. This is a point that has, unfortunately, been too much neglected in the past, and the importance of which is hardly yet realised. Some firms, endowed with the spirit of enterprise, are already doing this on a large scale, which will probably justify the trouble and expenditure involved. Greater encouragement might be given to young, technically-trained men to study foreign languages. At present a man who is able to write two languages fluently, in addition to his own, very often finds that the time spent in acquiring that knowledge has been wasted, owing to the insularity of the British manufacturer. How many Englishmen are there to-day, for instance, who could correctly translate a complicated electrical specification into, say, French, Italian, or Spanish? In that direction, too, the Germans were well ahead of us before the war. There were very few firms who were not able to give, promptly, quotations in the leading European languages. They found that it paid to do so. When, say, a Spaniard receives a specification from England written in English and bristling with technical terms, it is not to be wondered at that he should pass it into the waste paper basket, unless, of course, there should be any particular reason why he prefers the British article.

The amount of new electrical machinery required when peace comes will be considerable. Further, Spain and Italy are taking up in earnest the question of developing their hydraulic resources, and here a vast field is open to British enterprise. If all the schemes mature, there is sure to be an increase in electric traction and in the application of electricity to steel production. The South American Republics, again, are as yet practically untapped in regard to industries in which electric power will be of importance. It will thus be seen how necessary it is that competent men should be sent out to these countries to study conditions on the spot and to report as soon as possible after the declaration of peace, in order that manufacturers may be able to make their preparations in good time. Unless this is done, the Germans will find the field open again for their policy of penetration and monopoly.

A NOVEL TRANSFORMER ANALOGY.

By C. W. MARSHALL.

The principal characteristics of the static transformer can be demonstrated in a very simple way by means of a lever. A weightless lever would have properties corresponding to those of an ideal transformer. The lever arms are the primary and secondary windings, and the fulcrum is the core. The arm-lengths and acting forces are respectively proportional to the voltages and currents. The analogy is easily developed to include features of a commercial transformer, such as magnetising current and transformation losses, the former being represented by a constant bias weight and the latter by pivoting the lever on frictional bearings. Transformer impedance is demonstrated by varying the stiffness of the lever arms. A flexible lever corresponds to a high-impedance transformer—*i.e.*, one which can pass only a limited current with a given voltage, while a rigid lever represents a low-impedance or high-regulation transformer.



An auto-transformer is distinguished from an ordinary one by having both acting forces on the same side of the fulcrum.

The illustration of more advanced properties, such as the phase displacements in delta-star transformers and the separation of losses, requires somewhat more elaborate models, and the development of these should prove an interesting example for students. An illustrative example is given below :—

Transformer.		Lever.	
Capacity	20 K.V.A.	200 grammes.	
Trans. ratio... ...	200/100	Arm ratio ...	20 cm./10 cm.
Applied energy currents	100/200	Forces	100/200 gm.
Magnetising current	10 amps.	Bias weight ...	10 gm.
Total losses	1 KW.	Adjust bearing friction to suit.	
Impedance	10 %	Choose lever beam so that it sags to the supporting plane with forces of 100 × 10 and 200 × 10 gm.—*i.e.*, 10 times full load.	

GAS FIRING BOILERS.

The paper read by Mr. T. M. Hunter on this subject before the Institution of Electrical Engineers was discussed by the Manchester Local Section on November 27th.

Mr. T. R. Wollaston said the author's 6,000 cu. ft. of gas per ton of coal represented 2,700,000 therms. The same coal could be gasified to give 17,000,000 therms, or six times the amount of electricity, and the by-products, in which coke and coalite would not be included, would probably aggregate equal or greater value. Two or three references in the paper implied that gas-fired boilers should work at 80 per cent. efficiency. The "Bonecourt" worked at over 90 per cent., and he was satisfied that when the problem was properly tackled by skilled boiler makers at least 85 per cent. would be reached. This with a producer efficiency of 70 per cent (which would also be consistently obtained) would give substantially 60 per cent. all round efficiency, equal to what some electrical stations were now working at without by-products. He had carried out a series of tests on gas-fired Lancashire boilers with producer gas and with Bunsen type burners, of a type which Mr. Hunter had since improved; the tests lasted for nearly a week, and an average of 17 per cent. CO_2 in the gas, never any CO, and never more than 3 per cent. excess O was obtained.

Dr. Cramp said there was no particular advantage from the point of view of the amount of coal used in firing a boiler by gas. Gas could be used for boiler purposes either in a producer which was entirely apart from the boiler, or in a producer which was part of the boiler. The second proposal Mr. Hunter's paper did not touch upon at all. Many plants ought to be burning their coal more economically, and producing less smoke. For such cases, a producer attached to, or forming part of, the boiler was a method which should not be lost sight of. It was true, in that way one did not get the advantage of by-products, but such producers had been successfully built, and it had been shown that by their means greater economy in the consumption of coal per lb. of steam was obtained. The author said nothing at all about the use of coke for boiler firing; that was surely an alternative. The author pointed out the loss wihch occurred due to the fact that the whole of the hydrogen in the coal had to be oxidised, producing water which must be kept above the temperature at which it evaporated. If an economiser would stand the condensation of the water on its sides, the temperature of the gases could be reduced, and very much more heat could be got out of the flue gas. The economiser tubes were attacked by the condensed water because the water was not pure, but there were plenty of metals in use in chemical works and other places which would stand strong and weak acids of the nature of the acid which was produced. The author referred to the use of hot fireclay radiators, and that kind of thing; there was, however, a form of radiant energy which was not touched upon—radiant flames. Was it possible to use a flame, not of the Bunsen type but of the radiant type, arranged in the ordinary boiler tube, and thus get the radiancy needed without the use of this radiating fireclay? The question of the use of high-velocity flue gas was not really one of boiler efficiency at all; it was one of evaporation per square foot of surface, and the question whether it was best to use it or not was very largely one of capital cost. With regard to the Le Chatelier formula quoted in the paper, there was some doubt whether it had ever been sufficiently proved. It was a comparatively easy matter to design a Pitot tube which could be used to give accurate results. Mr. Hadley, in his paper on the Rand Mines, described a beautiful instrument which was used in South Africa for measuring compressed air, and the same principle might be adopted in this case. There was, of course, the difficulty that with a Venturi throat, gradual choking-up might result, but with the ordinary form of Pitot tube there was no trouble due to choking of that sort. It was at least as important to measure the air as to measure the gas, and it was the mixture that mattered. Mr. Frith some time ago designed and put into operation in Sheffield, in connection with a gas furnace, an apparatus for measuring both gas and air which had enabled combustion to be carried on in a perfectly regular manner, and in a way which was much more satisfactory than was possible before.

Mr. E. F. Winstanley said the paper contained a list of calorific values of gases, and a statement to the effect that in this country we quoted the number of therms in 1 cu. ft. at 60 deg. F. and 30 in. Hg.; in the table, however, the therms were given for 32 deg. F. and 30 in. Hg. This was an important matter, as anybody using these tables in the English units would find himself about 6 per cent. out in the estimation of the calorific value. There were mistakes in the calculated temperatures, and a big mistake with regard to the loss in efficiency due to the presence of water vapour; the loss to the flues was 14.5 per cent. and 18 per cent. respectively for the dry and moist gases, against the author's figures of 21 and 29.8 per cent. With this correction, there was only a difference of 4.5 per cent. in the output from a given quantity of gas, and not 12 per cent., as stated. Finally, the drop in efficiency was nearer 5 per cent. than 9 per cent., as stated, and the drop in evaporation only 13 per cent., and not 21 per cent.

Mr. S. L. Pearce said that from the national point of view there could be little doubt that to burn raw coal was quite unsatisfactory, but from the central-station engineer's point of view it was by no means demonstrated up to the present time that by the adoption of gas firing the engineer would be able to produce a unit of energy at a lower cost than at present. The problem might be helped to a solution by the experimental stations which would be established shortly at East Greenwich. He emphasised the fact that the two aims were by no means identical, and that, whilst we might be doing the right thing from the national point of view by the adoption of gas firing, it did not follow that it would enable the central-station engineer to provide energy any cheaper. He had not been able to take advantage of by-product gas, whether from coke ovens or from blast furnaces. Therefore, there were two alternatives—either to put down producer plant in its entirety, or else purchase gas. The author himself did not appear to be over-sanguine in regard to the former, because it had been found that steam could be raised more cheaply from the coal direct, even after allowing for all the income from the sale of by-products. With regard to the possible utilisation of town's gas, as a basis he assumed that no electrical authority, purchasing town's gas of which the calorific value was about 500, could afford to pay more than about 2½d. per 1,000 cu. ft. Did the author think it at all likely that gas authorities would be in a position to offer gas at that price to the electrical authority? If they could not, he saw very little chance of that co-operation which had been advocated in certain quarters. With regard to producers, he did not want to say too much, because he hoped that before very long, and in a place not many miles from there, it might be possible to install experimental plant working in conjunction with modern marine boilers. As to the suitability of gas for boiler firing, he was not at all impressed by the figures the author gave, in which he talked of its being possible, with suitable combustion arrangements, to obtain evaporations of 5½ lb. per sq. ft. At one of their stations they were putting down boilers of a marine type from which they fully anticipated getting 7½ lb. per sq. ft.

Mr. S. J. Watson said the author dealt with the use of gas for firing boilers, which at once raised the question whether that was the most efficient method of using gas. On the Continent the waste gases from coke ovens or blast furnaces were used direct in large gas engines, and from the point of view of thermal efficiency there was no doubt that better results were obtained in that way than by burning the gas under any form of boiler. By making use of the blast furnace gas, some of the large iron works had been able to reduce the cost of manufacturing iron by something like 4s. or 5s. a ton. The gas engines were mostly of large size, and consequently exceedingly efficient thermal results were obtained. The question of gas firing boilers was very largely one of securing a steady flow of gas; the amount of gas supplied from a blast furnace fluctuated within tremendous limits. The efficiency of a Lancashire boiler would be very low without an economiser, and with considerable moisture in the flue gases the rate of deterioration of the usual type of economiser tubes must be exceedingly high. On the whole, he was inclined to agree with Mr. Pearce that there was little likelihood that gas-producing plants for the firing of boilers were going to be substituted generally for the present method of coal firing. When gas was a by-product instead of one of the principal products, the position was quite different. With regard to the transmission of gas over appreciable distances, the distribution of gas over large areas could not be effected without suffering a severe loss. Mr. Hunter mentioned that the cost of producing one ton of steam was about 1s. 3d. from coke-oven gas. Coke ovens were invariably established at or near collieries, and the cost of 1s. 3d. approximately corresponded to coal at 10s. a ton. He did not imagine that the class of coal which would be used for generating steam at a colliery would have a value of 10s. in normal times; it would probably be more like 4s., or in some cases even less, so that the comparison in this particular instance was not a very happy one.

Mr. Daniel Adamson said that the water-tube boiler had emphasised the necessity for clean water, and the large gas engine the necessity for clean gas, and given clean water and clean fuel the possibilities in the way of improvement in boiler design were almost beyond our dreams. One such improvement would be the adoption of the Lancashire multitubular boiler. He showed a diagram of a boiler four of which were made 30 years ago, and were still at work giving good results. The feature of the design was an enclosed combustion space which avoided loses by air leakage or radiation, combined with a reasonable amount of heating surface, suitably arranged for cleaning. The smaller tubes could be swept through while the boiler was at work, and they were made with ferrules, so that they could be removed for scaling and replaced without damage. The large lower tube was for cleaning the combustion chamber of flue dust without stopping the boiler. If covering the brickwork with tar had been found to be satisfactory in general use, it seemed to be a valuable hint to all users of boilers. The author mentioned several methods of increasing the output of the boiler, but he thought that most of them were illusory compared with the fourth method, especially if clean fuel and water were available. Referring to Dr. Nicolson's experiments, in one portion of the paper the author said the gases were reduced from 1,260 deg. C. to 425 deg. C. in the passage through the flue. That was not quite correct. There was a brick plug in the flue, but the reduction of the temperature in passing that brick plug was from about 1,260 deg. C. to about 700 deg. C., and the 425 deg. C. was the temperature after the gases had passed through what was called the evaporator, which was the next element in the arrangement. When the gases had gone through the economiser, which was the third step, the temperature was brought down to 135 deg. C. The author stated that sufficient heat was transmitted to evaporate 36 lb. of water per sq. ft. of the flue tube per hour; the original report of Mr. Michael Longridge showed that over 40 lb. of steam were evaporated per sq. ft. per hour, and stated that the essence of the system was the saving of heating surface by using high gas velocities. His own view of Dr. Nicolson's experiments was that they put boiler design on a scientific basis.

Ald. Walker said the question had occurred whether there would be any increase of efficiency if the temperature of the primary air were raised, and if so, whether it would not be possible in a central power station to make use, for that purpose, of the heated air from the alternators; the deciding factor would be cost of piping as against increase of efficiency. The ratio of the space required for the producers to the space required for the boilers which they served in many cases would be decisive as to whether or not gas-firing could be installed. As the space required for the producers for very large boilers going up to 100,000 lb. evaporative capacity per hour was greatly in excess of that required for the boilers themselves, it would alter the lay-out of the station and necessitate the covering of much more land. He did not agree with Mr. Watson that if gas was to be used at all, it ought to be used in internal-combustion engines; the overall thermal efficiency of the internal-combustion engine had been equalled by that of the boiler plus turbine in the case of large sets. The high initial cost of gas engines, together with the troubles in running them and other incidentals thereto, were convincing that the future was with large steam turbo-alternator sets. In a central power station, the place where increased efficiency was to be obtained was the boiler house. The series of papers which had been read on steam raising agreed that from 80 per cent. to 85 per cent. efficiency ought to be obtained. If this could be done by producer gas or town's gas, then the question of by-products would assume extreme importance. Before so radical a change as that advocated in the paper was adopted, experimental work on fairly large boilers ought to be undertaken.

Mr. Berry said that a very large experimental "Bonecourt" boiler was put in at the Skinningrove Ironworks. It was fired with gases from coke ovens. The efficiency, on several tests, was maintained at 92 per cent.; 2½ per cent. was deducted for the fan, so that the efficiency was 90 per cent. No other boiler yet designed came near that in heat efficiency It was so satisfactory that the Skinningrove Co. ordered a second boiler. They were 10 ft. in diameter, and 4 ft. long between the tube plates. Every tube had a short plug through which a narrow pipe about ¾ in. in diameter was led. These pipes were packed with refractory material. The gas was allowed to flow in and lighted. Ignition took place, and the refractory material got heated up for a length of 3 ft. Then the gas was turned on again, and the flame combustion took place, with the result that the whole tube inside became an incandescent mass. An evaporation of 20 lb. per sq. ft. of tube surface was attained. A fan was required to draw gas through this refractory material, and it was found that the fan required about 17 in. water gauge to give satisfactory results. A marine boiler put in at the Birmingham Battery Co. evaporated 11,000 lb. an hour, and the efficiency was just about the same. At the present time boilers were being designed for Government purposes capable of carrying 1,250 lb. pressure. The only thing against the system was the innate conservatism of engineers, who did not like anything new until the man next-door had done the experimental work, and then they were willing to benefit by his experience. The "Bonecourt" boiler was the most scientifically designed boiler known. The temperature was graded, and it was possible to get down the temperature of the gases discharged at the end of the boiler to just a few degrees above the steam temperature.

Mr. Hunter, in reply, said he had not put the results of actual tests in the paper because it was very difficult to get results of tests of gas-fired boilers that were absolutely reliable. Large boilers fired with coke-oven gas, without economisers, gave an efficiency of 85 per cent. They were further tested by an outside engineer some two years or so after they had been set up, and he found that the efficiency then on ordinary working was 83 per cent. The exhaust temperature of the gas was considerably below the steam temperature. From that point of view they compared favourably with the "Bonecourt" boiler. It was quite time that those who were preparing alloys should produce an alloy for the tubes which would enable manufacturers to make a smaller economiser and give a very high additional efficiency with gas firing and clean fuel. Only last week a man who had been ten years in Germany, and had seen some of the best practice there, gave a figure for clean blast-furnace gas working on a boiler of the Lancashire type with economiser; 82 per cent. was the efficiency they obtained. He had known works in this country which approached that figure, but really, before the war the Germans were ahead of us in gas firing. His experience had been mostly with Lancashire boilers in the open air without economisers, and the best efficiency he had found with a Lancashire boiler with economisers was a little over 75 per cent. It might have been considerably increased with a more perfect plant.

The Selenium Cell as a Burglar Alarm.—A sensitive selenium cell has been devised by Dr. O. Hannach, of Berlin, which is able to actuate an alarm signal when illuminated by the flame of a match at a distance of 10 metres: it can easily be concealed in a room, and has the advantage that it can be situated, with its wiring, at a distance from the safe or other valuables that it is intended to protect, in an inaccessible position: as a burglar can hardly work without a light, the idea appears to be a good one. Moreover, the same device would prove effective as a fire alarm. It has the drawback, however, that it can only be used in rooms that are normally in darkness.

A NEW TYPE OF ENCLOSED MOTOR.

The advantages of totally-enclosed motors over the open type or semi-enclosed have been obvious to electrical engineers for many years past, especially in cases where the atmosphere is charged with dust or deleterious matter. The chief factor which has prevented the universal adoption of the totally-enclosed motor is the limitation of output due to the increased heating of the motor. The general consensus of opinion is that totally enclosing a motor reduces the permissible H.P. output to 40 per cent. of the permissible output of the same sized motor of the open or protected type. This rule applies to motors up to 40 H.P. For larger motors the output is still more restricted by totally enclosing. The total heat which can be radiated from a motor is proportional to the surface of the motor, and it is obvious that this does not increase in the same ratio as the cubical contents of the motor, whereas the permissible output of an open-type machine is nearly proportional to the total volume. It is found that the restrictions of output by totally enclosing on large motors of 100 H.P. upwards are sufficiently severe to make this type of motor unpractical on account of its unwieldy size, weight, and expense. This, translated into £ s. d., means a greatly increased initial cost of installation and upkeep. In addition, the efficiency of the totally enclosed motor is generally lower than that of the open type, especially on light loads, due to the increased size of the motor. Size and weight are also in many cases a deterrent in the use of the totally-enclosed type. This is especially the case in marine installations.

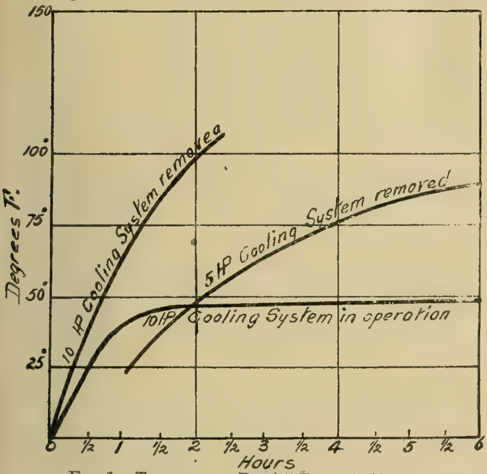


Fig. 1.—Temperature Rise, "Emcol" Motor.

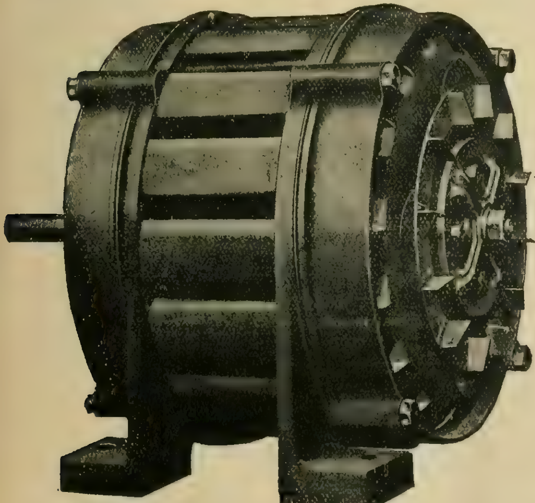


Fig. 3.—Motor with Casing Removed, showing Air Channels and Fan.

Attempts have been made to overcome these objections, the pipe-ventilated motor being a well-known instance, but the necessary trunking is sufficient to prevent the extensive use of this type of motor. It is necessary in this type of motor to run trunking to a supply of clean air, and as this is often taken from outside, the motors may be adversely affected by moisture being drawn into the motor; this sometimes takes place after motors are shut down. Latterly, other inventions have appeared in which the air is circulated from inside the motor through various systems of cooling devices and returned to the motor after cooling. These devices have proved partially successful, but they all require an apparatus of considerable bulk external to the motor, needing space which is not always available. In other words, the total bulk of the motor and cooling system is quite equal to, and generally greater than, the space occupied by a standard type enclosed motor.

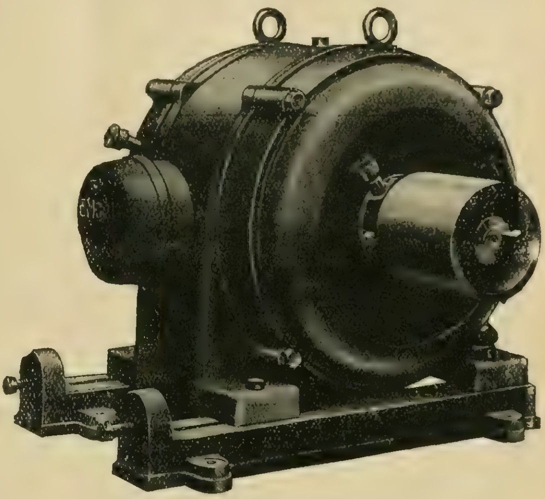


Fig. 2.—"Emcol" Squirrel-cage Motor.

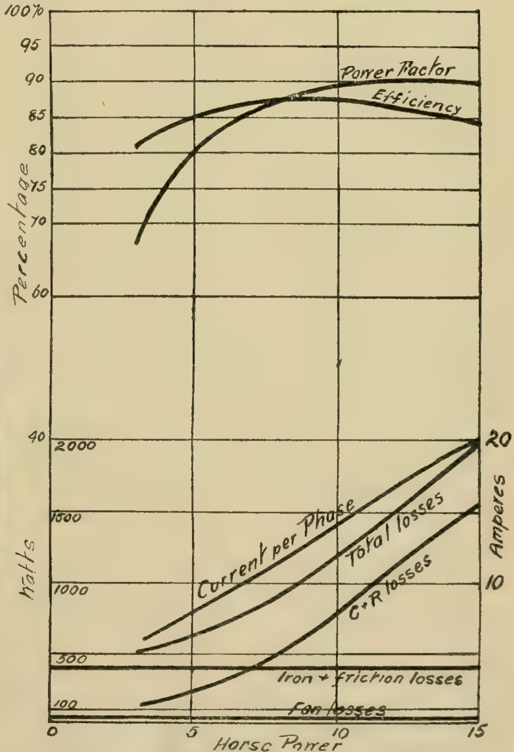


Fig 4.—Performance Curves, 10-h.p. "Emcol" Motor; 4-pole, 50-cycles, 3-phase.

Recently Mr P. A. H. Mossay and Mr. H. C. E. Jacoby have jointly attacked the problem in a novel and practical manner, and have produced a motor which is maunfactured under the trade name "Emcol." It is totally enclosed, and complies in every respect with the definitions of a totally-enclosed motor as defined by the Admiralty standard specification for electric motors for use on H.M. ships, and with the British standardisation rules for electrical machinery.

They claim for their motor that the output for a given temperature rise is even greater than that of an open-type motor of equal bulk and weight. The cost of production is practically the same as for the ordinary standard open-type motor. The makers anticipate that in the near future the great majority of motors will be manufactured on these lines, it being obvious that if the totally-enclosed motor can be produced for the same price as the open type, this latter will die a natural death.

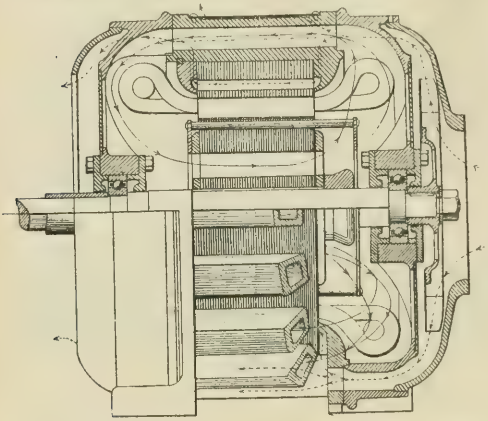


Fig. 5. Diagram Showing Air Circulation in Motor: Dotted Lines Show External Air Currents.

The chief characteristic of the invention to which we refer is the circulation of the air inside the motor through a cooling system cast integrally with the frame in such a manner that the external dimensions are not appreciably increased. In the case of A.C. motors the cooling chambers are virtually channels cast in the webs which support the laminæ, so that the actual weight of a housing built according to this method is not greater than that of the ordinary standard motor. The cooling channels are cooled by drawing cold air from outside through another series of channels ingeniously arranged so that the cooling air entirely surrounds the hot-air channels. The crux of the invention consists in crossing over the two currents of air so that the cooling air is also in contact with the outside of the stator laminæ. By this means a very large area of cooling surface is obtained. The cooling air does not enter the motor in any way, but merely blows through the space between the outside periphery of the laminæ and the removable cover.

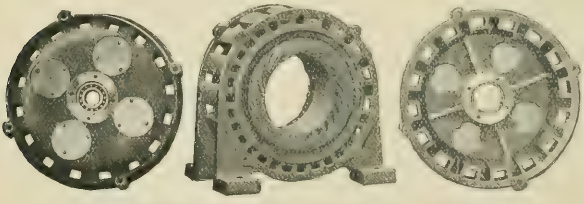


Fig. 6.—Motor Dismantled, showing Air Channels in Frame and End Shields.

In D.C. motors the cooling system consists of chambers cast in the magnet ring in such a manner as not to interfere with the distribution of the magnetic flux.

Our views are taken from photographs of a 10-H.P., 3-phase motor, the electrical portion of which was a standard design for 10-H.P., 4-pole open type, 50 period machine, which on a six hours' full-load test, showed a temperature rise of only 54 deg. F. on the winding, the temperature rise of the air inside the motor being 46 deg. F. When overloaded to 14 H.P. the final temperature rise was 65 deg. F. on the winding, and of the air inside, 59 deg. F.

For purposes of comparison, tests were taken on the same motor with the cooling system rendered inoperative, so as to bring the motor under the condition of an ordinary totally-enclosed motor. The results of these tests are shown by the curves.

It should be explained that as the motor would only carry a reduced load under these conditions, the voltage was reduced in proportion to the square roots of the loads, so as to give the best efficiency on the reduced load.

The results may be roughly summarised as follows:—

1. The output of an "Emcol" motor with a given temperature rise is the same as, or better than, the output of a standard open-type motor of the same weight and bulk.

2. The output of the "Emcol" motor is two and a half times larger than the output of a standard totally-enclosed motor of the same weight and dimensions.

We understand that the invention is fully protected by patents, and that the Enclosed Motor Co., Ltd., has been formed to deal with the patents, grant licences, &c. Manufacturers interested should communicate with this company.

THE LUBRICATION OF AIR COMPRESSORS AND DIESEL ENGINES.

At the meeting of the Diesel Engine Users' Association on November 15th lubrication questions were discussed. A note by Mr. J. Veitch Wilson dealt with the subject from the point of view of an oilman with a prolonged experience in the lubrication of internal-combustion engines at home and abroad. He found general agreement that lubricants for Diesel engines should be pure mineral oils. The presence of a liberal supply of oxygen leads to the decomposition of vegetable oils, producing fatty acids and causing the oils to gum; in the power cylinders of well-designed internal-combustion engines free oxygen is practically absent, and in many such engines fatty oils are used with satisfactory results. In the air compressors the conditions are entirely different, and it appeared reasonable to the author that fatty oils or compounds should be excluded from them; nevertheless, he found that in some cases the addition of a small proportion of fatty oil to high-class pure mineral oil put an end to deposits and sticky valves, and gave complete satisfaction.

While in steam engines using steam superheated to 600° or 650° F. a cylinder oil of flash point not lower than those temperatures was used, an oil of 400° F. flash point gave satisfaction in internal-combustion engines, though the temperature of explosion might reach 2,000° or 2,500° F. The explanation of this anomaly appeared to the author to lie in the cooling of the cylinder walls in the latter case by a water jacket, so that their temperature did not exceed 250° F.: there might also be a flameless zone close to the wall, due to the chilling effect of the water jacket, so that the lubricating oil never reached the temperature of decomposition.

Mr. G. W. F. Horner also read a paper, giving particulars of his experience with an installation of Diesel engines and compressors. In 1916 trouble occurred due to a deposit in the I.P. purge pot, which caused excessive wear of the H.P. compressor piston and rings; a brownish substance, looking like rust, dried out in the H.P. stage, and acted on the working parts like emery powder. The oil used and the deposit were examined for the author by a chemist; the former was found to be a pure mineral oil, and the latter was chiefly oxide of iron, which apparently was formed in the purge pots in the presence of air, carbonic acid, and water. To prevent this action, the author had the purge pots painted with a rust and acid-proof paint consisting of 3 lb. English flake iron to 1 lb. of boiled linseed oil; the result was most satisfactory. The author concluded that the formation of the greater portion of the iron oxide took place in the I.P. cylinder and purge pot, and that the protection of the iron and steel surfaces by the paint described was advantageous. He found the internal surfaces of the air receivers rusty, with a deposit similar to that in the I.P. purge pots, and had them also cleaned and painted.

In the discussion, Mr. R. L. Quertier pointed out that Mr. Horner's plant was close to the sea, where the air contained moisture and salt. He recommended a mineral oil containing a small percentage of animal oil for the compressors, in preference to mineral oil alone.

Mr. W. Fennell considered that if the working conditions of the compressor were good, standard oils of widely different characters could be used with success; the working temperature should be capable of regulation, and a small discharge of air should be allowed from the intermediate purge pot. He doubted whether it could be assumed that the inner skin of the cylinder liner was always at a temperature below the carbonising point of oil.

Mr. E. Shackleton pointed out the danger of throttling the air suction, which had led to explosions in the intercoolers due to the volatilisation of the lighter fractions of the lubricating oil in the partial vacuum. Owing to the liability to the formation of troublesome deposits in engines burning heavy oils, a thinner lubricating oil should be used in these engines, and water injection was advantageous.

Mr. C. O. Milton pointed out that pure mineral oils could easily be cleaned by heating in contact with boiling water, and used again; compounded oils were not so readily cleaned. Filtering and settling arrangements such as were used in power stations were too slow in view of the large quantities of oil to be dealt with. For air compressors, experience was overwhelmingly in favour of a suitably compounded oil. Water condensed from the air was the cause of the trouble, as it washed the pure oil off the metal surfaces.

Mr. Napier Prentice had had trouble with H.P. piston rings supported by floating carriers, which was obviated by adopting a tightly fitting sleeve in the carriers.

Mr. J. Milton had experienced trouble due to changing from compounded to pure mineral oil in the air compressors.

Mr. J. W. G. Brooker agreed with Mr. Quertier that moist air laden with salt was favourable to rusting, and tended to the formation of hydrochloric acid.

Mr. P. H. **Smith** gave details of practice at Leatherhead, showing the great importance of guarding against the formation of acid in the compressor, which led to burst H.P. copper coils and leaking blast-bottle fittings; by increasing the L.P. pressure and reducing the H.P. maximum temperature, and using a lubricating oil which gave very little acid reaction, the acid in the blast-bottle had been greatly reduced, and the failures of parts minimised.

Commenting on Mr. Horner's communication, **Mr. J. Veitch Wilson** pointed out that, on changing from one oil to another, deposits might be dissolved and discharged, bringing discredit on the latter oil, which was actually clearing the cylinders of troublesome matter. Replying to the discussion, he pointed out that while mineral oils were not saponifiable, most of them produced troublesome emulsions when mixed with water. For cleaning used oil, two settling tanks were useful, one to receive the oil from the engine while the other was at rest; the oil from the latter should be passed through a sieve, and used for bearings and machinery, but he did not recommend it for cylinders. Compound oils could be cleaned in this way.

Mr. Horner likewise discussed Mr. Wilson's paper, expressing a preference for the use of mineral oil throughout. Replying to the discussion, he emphasised the fact that chemical action was the main cause of the troubles with his engines, which were removed by painting the parts affected.

Mr. J. H. Garratt communicated some notes on his experiences at Singapore, where he traced an excessive formation of acid to the use of foul oil from the crank chamber for lubricating the compressor. To indicate when the H.P. air pipes were corroded to a dangerous extent, the pipes were drilled half way through with a V-shaped drill point, causing a very slight blow when the surface wore down as far as the point of one of the V's. Owing to wear, the blast receivers had to be discarded, and, as they could not be replaced from England, the engines were run without them with successful results.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Proposed Institution of Electrical Station Engineers.

As one of those who attended the meeting at Hammersmith of senior technical officers of electrical power undertakings of Greater London, I had hoped with others that the foundations had at last been laid for the building of an association which would include in its membership every qualified engineer, ranging from chief to junior, engaged in the electric power supply of the United Kingdom.

For some reason or other the movement does not seem to be progressing; whilst one cannot ascertain from whence the opposition is arising—it is apparently there; the enthusiasm and keenness seem only to be shown by the junior staff. Senior and chief officials, as usual, either think it beneath their dignity to take any active part in the movement, or are apathetic; this attitude is most unfortunate, as the time has never been more opportune, or the need greater, for such an association.

As one of the arguments put forward by the disinterested is that no general desire has been expressed for such an association other than by the promoters of the meeting, it would no doubt assist its successful launching if the chief engineers and senior technical assistants in the Provinces, who would support such an association, sent their names to the hon. secretaries of the respective London Associations, the names and addresses of which you, no doubt, would give. I believe that this support has already been given by the staff of provincial stations.

In conclusion, I sincerely hope that the chief engineers of the United Kingdom and their senior officials will not let this great opportunity go by of forming a live Association, the object of which would be solely the protection of interests, and, in a few years' time, find that they are the only ones who have no opportunities of having any redress against grievances which all in the electrical world realise will arise.

Can it be due to a "hidden hand" influence that is interested that such an Association is not formed?

A. M. P. A.

Illuminating Engineering.

I venture to question the wisdom of Mr. A. P. Trotter's remarks in his presidential address to the Illuminating Engineering Society, as reported in your issue of 4th inst.

It seems to my mind to encourage the idea that a qualified illuminating engineer has done his duty to himself in accepting the sense of sight as judgment from one whose mind he has omitted to tutor in its requirements.

Low "diversity factor" and diffusion of sources being the two important conditions for a high standard of illumination, it is well known that the uneducated will more frequently interpret the loss of intrinsic brilliancy as reduction in illumination, and subordinate diversity factor (which is insufficiently preached) to foot-candle intensity. Moreover, whilst the eye can at once distinguish a diffused source from an intensely brilliant one, it is little able of itself, unaided by instrumental measurement, to rate the value of the diversity factor in an installation.

Whilst the eye as an instrument can be relied upon to test whether a preconceived impression has been accurately conveyed to the brain, good illumination is not so much concerned with impressions as with effects upon the muscles and nerves created by those impressions, and these should be the qualities which an engineer elucidates to his clients as being essential to rapid vision and greater physical endurance.

More liberal education from engineers, direct to the public, on the action of light upon the eye, will better assist the illuminating engineering movement and promote increased commerce.

Sydney O. Cook.

Glasgow, *January 7th*, 1918.

[In justice to Mr. Trotter, we must point out that our report gave only brief extracts from his long and interesting address.—Eds. Elec. Rev.]

Meters on a Changed Frequency.

A company is desirous of obtaining a supply of electricity in bulk, and would like the opinion of your readers as to how it will affect the meters:—

1. Present supply is single-phase—220 volts, 40 periods; the new supply will be at 50 periods. What would be the error of the meters if connected to the 50-cycle supply, the voltage being the same?

2. Could the voltage be adjusted to make the meters accurate? If so, what would be the voltage?

Query.

Distinctive Colours for Braided Cables.

With reference to the letter signed "T. D. Spark," in your issue of December 28th, the leading British cable manufacturers make white-braided rubber cables as well as red and black. White-braided cable is made chiefly for the Tropics, and in India practically no red braiding is used, as, for some reason which, I believe, has never been satisfactorily explained, the rubber perishes more quickly with red than with either white or black braiding, in Tropical climates.

T.

January 2nd, 1918.

The Production of Ductile Tungsten.

As solicitors for Duram, Ltd., the well-known manufacturers of ductile tungsten for filament lamps and other purposes, our attention has been called to the letter of Mr. John Gray in your issue of December 28th, and to his statement that "British Thomson-Houston Co. were supplying their whole requirements of ductile tungsten for Mazda lamp filaments in 1912 by manufacture at their Rugby works."

Mr. Gray's statement will be received no doubt with amusement by many lamp manufacturers in this country, but there is really no excuse for the inaccuracy of his statement, inasmuch as Mr. Fraser, the secretary of the British Thomson-Houston Co., in an affidavit filed by him in the action brought by that company against Messrs. Duram, Ltd., for infringement of their Patent No. 21,513 of 1906, which action was dismissed by Mr. Justice Astbury and the Court of Appeal, swore that between October 1st, 1912, and September 30th, 1913, the total production of tungsten wire drawn at Rugby, as evidenced by the production sheets, was 5,835,686 *feet*; of which more than two-thirds—viz., 3,824,247 ft.—were drawn from tungsten rods and coarse wire imported from the General Electric Co. of America.

The total production of finished wire manufactured and drawn in its entirety at Rugby was only 2,011,839 ft., and the value of much of that for lamp-making purposes can be appreciated, since the production sheets show that quantities of this were in lengths of less than 100 ft.

Allowing for wastage only 20 per cent., which would be very generous at that date, and allowing 3 ft. to a lamp, the British Thomson-Houston Co. only made wire in its entirety for 536,490 Mazda lamps during the period mentioned. It will, in addition, be noted that this period includes nine months of 1913, whereas Mr. Gray speaks of 1912, when his company could hardly have been more successful.

Having had his attention called to the matter, Mr. Gray would not wish us to omit to notice that the secretary also admitted the importation of lamps from America during the same period.

Having proved the inaccuracy of Mr. Gray's statement, we may be permitted to add that our clients, Messrs. Duram, Ltd., are, and have for some time past been, manufacturing millions of *metres* of drawn tungsten wire at Hanwell, and are far more competent to supply the whole of the requirements of the United Kingdom than the British Thomson-Houston Co.

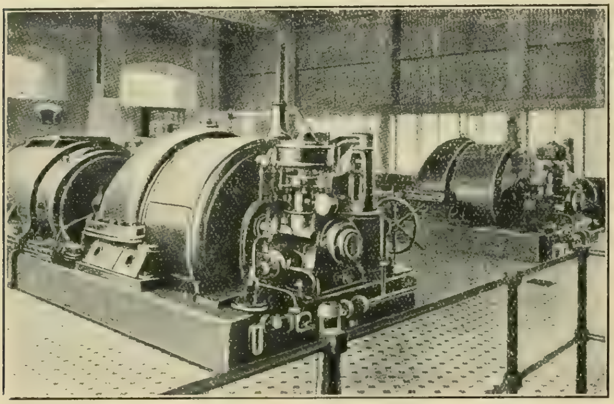
Speechly, Mumford & Craig.

London, W.C., *January 8th*, 1918.

ELECTRICALLY-DRIVEN CEMENT WORKS.

In a paper read before the Institution of Engineers and Shipbuilders in Scotland, by Mr. B. J. Day, the works of the Aberthaw and Bristol Channel Portland Cement Co. were described in some detail, the latter including particulars of the electrical equipment—the works being electrically driven throughout from a private power station.

The processes employed in cement manufacture have been described several times in our pages; that employed at Aberthaw is the wet process. The works have been erected on the limestone beds, and the quarry has been opened at the nearest point, allowing space for a six-kiln plant, capable of turning out 360,000 tons of cement annually, though the first installation consisted of a two-kiln plant to deal with 120,000 tons of cement per year.



Turbine Plant at Aberthaw Cement Works.

The materials are quarried by a steam navvy and broken up in two jaw crushers, being then delivered to wet mills, consisting of four-ball and four-tube mills.

At Aberthaw four of the largest size mills have been installed, each pair of ball and tube mills being driven by a separate 350-H.P. motor. The latter are installed in a motor house distinct from the mill house, and drive extensions of the mill shafts. The slurry obtained from the mills is delivered to two storage tanks of a sufficient capacity to manufacture 600 tons of cement, in which the mixture is adjusted to the correct proportions. The slurry is subsequently pumped into two revolving kilns, each 200 ft. long, 10 ft. diameter in the burning zone and 9 ft. diameter in the parallel section. Each kiln is gear driven by an electric motor, at a point about half way in its length, the gearing giving a maximum speed of one revolution in 55 seconds.

The clinker delivered from the kilns, after being cooled, is passed through grinding mills consisting of preliminary ball-tube mills and finishing tube mills, and the finished product is conveyed to a 10,000-ton silo consisting of 20 500-ton bins.

The electrical arrangement of the clinker grinding house resembles that adopted for the wet mill. One of the most important items is the plant for the preparation of pulverised coal for the kilns.

Each ton of clinker requires about 5 cwt. of coal; the latter is stored as received from the colliery in bunkers, which discharge automatically on to conveying plant delivering to crushers, which reduce all large lumps.

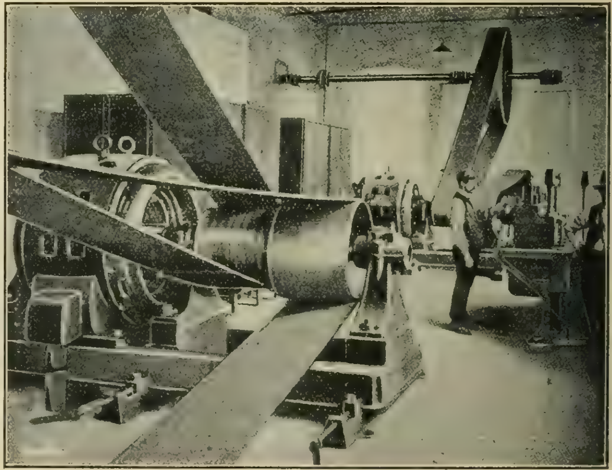
The crushed coal is passed through a revolving dryer, and subsequently pulverised in ball and tube mills, so that the residue does not exceed 5 per cent. on a 100^2 mesh sieve. Most cement works rely upon one or more main low-speed engines for their supply of power, supplemented in some cases by one or more smaller electric generating sets for small machines or outlying machines. The main engine drives one or more long countershafts by ropes or belts, or both. The effect of this is to cramp the whole of the works, and necessitates laying down various machines where they can be most easily driven. The result is numberless small cross-belts and countershafts entailing heavy upkeep costs, besides undue waste of power. Compared to many modern cement works, the simplicity of the arrangements at Aberthaw appeals to the works manager, apart from the economy involved. After having closely studied modern methods of manufacture in this country and on the Continent, Mr. Day, although it was a novel idea in this country, decided to drive the whole of the plant throughout electrically. By adopting this system an extremely simple layout was obtained, and one that can be extended very easily should trade warrant it.

Owing to the excellent supply of water, it was decided to lay down two turbo-generators, each having a capacity of 1,500 KW. The steam-raising plant consists of five 30-ft. Lancashire boilers, each fed by elevators which deliver coal from the storage bunkers to the hoppers on the front of the boiler, from whence it passes to Bennis stokers. The boilers generate steam at 180 lb. pressure, the steam being superheated to about 600° F. A Green economiser is installed, and the draught is provided by an induced draught fan and compressed air on the Bennis system. A Sulzer turbine-driven boiler feed-pump exhausts into a condenser fitted in the hot-well tank; with this arrangement the whole of the latent heat is recovered, and the thermal efficiency is a maximum.

The generating plant consists of two 1,500-KW. Escher-Wyss turbines driving Brown-Boveri and Siemens generators respectively, with direct-coupled exciters, and supplies three-phase current at 50 cycles and 3,000 volts. A wet air-filter is provided for the alternators, as trouble is experienced with cloth filters in cement works owing to the cement dust adhering to the fine hairs on the cloth. The condensers are of the counter-current surface type, with rotary-type pumps. Each set has its own condensate pump and dry-air pump, electrically driven. Over the hot-well is fitted a notch tank connected to a Lea recorder.

The condenser circulating pumps are installed in a small pump house close to the river, each driven by a 40-H.P. motor. The pumps do not require this power except at starting, as a siphon pipe has been installed connecting up the outlet of the condensers to a water seal at the same level as the pump house; so that really the pumps have to deal with the friction in the condensers and piping, plus a short suction head. In the pump house also are installed two Rees-Roturbo pumps, each motor-driven, for the general water supply of the works. A large quantity of water is used, not only in the raw grinding mills themselves, but also all mill and kiln bearings are water-cooled, thus economising lubricants.

All motors above 50 H.P. are supplied direct at 3,000 volts pressure; all smaller motors and lighting at 220 volts. The main switchboard, by the B.T.H. Co., consists of 13 panels, controlling both generators, and two 400-KW. oil-cooled transformers supplied by the British Electric Transformer Co. From this board are also run separate circuits to the crusher-house, raw-mill, clinker-mill, and coal-mill; as it is essential that there shall be no possible interference with the running of the kilns, each is separately supplied from the main board direct. Distributing switchboards are fitted in the raw-mill, clinker-mill, and coal-mill; each mill unit is separately controlled, and can be stopped immediately by pressing a button on the feed platform. All the above switchgear is of the totally enclosed dust-proof oil-immersed type.

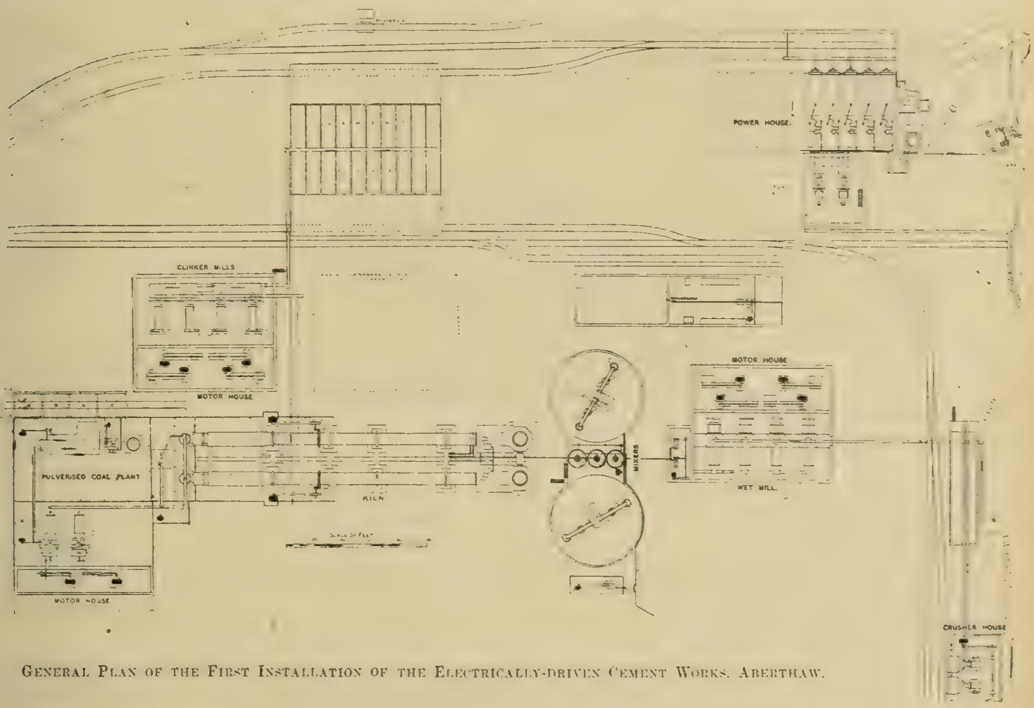


Raw-Mill Motor House, Aberthaw: a similar arrangement is adopted for the Clinker Mill.

The low-tension board consists of 10 panels with 12 power circuits and 9 lighting circuits.

As is well known, the dust-laden air in a cement factory is full of highly hygroscopic particles of dust, which are injurious to insulation, and special precautions must be observed to prevent dust reaching the windings. For all large motors above 100 H.P., special motor rooms have been provided, in which the motors are installed, which can be made practically dust-proof. Each motor drives a ball and tube-mill unit through belts attached to specially extended countershafts. All motors over 50 H.P. and up to 100 H.P. operate at 3,000 volts pressure, and are of the pipe-ventilated type; motors over 5 B.H.P., and up to 50 B.H.P., operate at 220 volts pressure, and are also of the pipe-ventilated type. All 5-H.P. motors and smaller are of the totally enclosed type; with this arrangement it is obvious that the air passing to the motor windings can, whenever necessary, be completely controlled and filtered.

The switchgear throughout is of the dust-proof type. The low-tension distributing boards consist of cast-iron boxes mounted on brickwork bases and are dust-proof. All the cables are of the B.I. & H. three-core paper-lead type laid in brick ducts with cement slabs over, one main cable trench being carried through the works.



General Plan of the First Installation of the Electrically-driven Cement Works, Aberthaw.

A total of 42 motors of 731 H.P. is included in the installation, including eight 350-H.P. and two 100-H.P. machines. These motors are of Swedish G.E., B.T.H., and Siemens make, and Mr. Day mentions, as a feature of the installation, that accurate figures have been obtained with the electric drives of the power required per ton of output with varying degrees of fineness from the different machines. [We understand that the plant has been extended recently.—Eds. Elec. Rev.]

WAR ITEMS.

Raw Asbestos Order.—Under the Defence of the Realm Act it is ordered that no person or company shall sell, supply, or deliver any raw asbestos, including asbestos crude and asbestos mine fibres, or purchase or negotiate or take delivery of any raw asbestos, &c., except under licence or permit issued by the Admiralty. Those engaged in the manufacture or sale of asbestos or asbestos products will be required to make returns.

Exports to China.—The "London Gazette" for January 8th contains a list of further persons and bodies in China to whom exports may be consigned.

The Fire at Krupps.—The Dutch newspaper "Handelsblad," in reference to the fire at Krupp's Essen works last month, says damage estimated at some millions of marks at least was done and over 200 electric motors were made totally unusable.—*Times.*

Trading with the Enemy.—The "London Gazette" for January 4th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Bolivia, Brazil, Central America, Chile, Cuba, Greece, Netherlands, Netherland East Indies, Norway, Peru, Spain, and Sweden.

Tank Week at Birmingham.—The staff and employés of the Birmingham electric supply department showed very practical interest in "Tank Week," by which well over six millions were obtained, thus establishing a record for this country. The electric supply employés headed the list of the Corporation departments with a contribution of £10,000, the gas department following with £7,405. The Electric and Ordnance Accessories Co.'s employés invested £52,653.

A feature of Birmingham "Tank Bank" week was the subscriptions from the working classes, who took full advantage of the various schemes different firms put into operation to enable their employés to participate. Staff and employés of Messrs. J. H. Tucker & Co. were able to purchase War Saving Certificates, repaying the firm for them by easy weekly instalments of any amount, as low as 3d. per week per certificate, with all the advantages as regards interest as though they had paid immediately the full purchase price. In the event of an employé leaving before the whole of the instalments are paid off (1) the employé can pay off the balance, or (2) the firm will repay in full the instalments already paid and retain the certificates. The result was application for the handsome total of 4,500 certificates, in addition to the firm's own contribution of £20,000.

Exemption Applications.—An electrician (40, B 2), who appealed at Brighton, was given two months' exemption.

At Sheffield, an appeal was made by G. West (37, C 3), electrician, and he was given exemption until March 31st.

BUSINESS NOTES.

Italy.—There has been formed, at Bovisa, the Società Anonima Cerettise Tanfani, with a capital of 5,000,000 lire, its objects being the construction of rope railways, aerial lines, telegraph lines, cranes, &c.

Società Anonima Italiana Carboni Elettrici is the style of a company, with a capital of 4,000,000 lire, established at Rome, for the manufacture of electrodes for electric furnaces.

With the title of Società per lo Sviluppo della Cianamide e di altri Prodotti Chimici, a company has been formed at Rome, under the auspices of the Banca Italiana di Sconto, with a capital of 12,500,000 lire.

Suction Gas Plants for Sale.—The Ton Pentre (Rhondda Valley) Co-operative Society and the Ynyshir (Glam.) Workmen's Hall and Institute have each a complete suction gas plant for disposal. For particulars see our advertisement pages to-day.

The New Board of Trade Journal.—The first issue of the *Board of Trade Journal and Commercial Gazette* (sixpence weekly) in its altered form appeared on January 3rd. It contains a "foreword" by the President of the Board of Trade and in a series of special articles there is given a good deal of informative matter such as the industrial and trading community will doubtless welcome. In our opinion it gives promise of being of considerable service in assisting traders and in encouraging trade development. The article on "After-War Trade: Reports of Departmental Committees" brings together the objects, personnel and work of these committees in a concise form, though still leaving our thirst for information respecting the detailed doings and conclusions of some of these committees unsatisfied for the present. In due course, however, even this want is to be supplied to some extent in a series of special articles which we naturally await with interest. A first article on "The Patents and Designs Bill," which came before the Commons in November last, describes the provisions and purpose of the measure, and it is to be followed by another explaining some of the clauses not covered in this opening contribution. The article on "Commercial Information: Methods of Distribution" ought to be carefully read by everybody in the electrical industry so that they may know exactly what the new Department of Overseas Trade (Development and Intelligence) is either already doing or is prepared to do for them in support of their own export trade efforts. The other contents of the *Journal* include a large collection of trade news, information collected from different parts of the world, Government notices affecting trade, and Customs' Regulations and Tariff changes such as readers of the old journal had long been accustomed to. We prefer the new and less monotonous looking manner in which the information is served up. We wish those who are responsible for the conduct of the publication every success in their endeavours to make the *Journal* an official record of increasing value. Under war-time conditions no journal can do all that it would. Paper restrictions necessarily hamper us all, a most regrettable circumstance seeing the vital necessity for having all our trade armour and weapons ready for the days that are to come.

The British Engineers' Association.—An official Directory of Members (1917), has been issued by the British Engineers' Association, of 32, Victoria Street, Westminster, S.W. 1, price 5s. It is a volume of over 400 pages, in a stiff white cover, with patriotic design in suitable colouring. The letterpress is printed in three languages—English, French and Russian. The fact that membership is a guarantee of British origin of manufactures is the first point put forward, and an invitation is given to engineering visitors from the Colonies and Allied or neutral countries to call at the offices in London. The book is divided into several sections, which are led up to by an introductory statement concerning the Association and its work. Part I consists of a Directory of Members and their addresses, also telegraphic addresses and codes. Part II classifies their manufactures according to the British alphabet, and Part III according to the French and Russian alphabets. The remainder is devoted to a very large collection of illustrated announcements or advertisements by certain B.E.A. Members. The Association invites applications for copies of the Directory from consulting and managing engineers, municipal engineers, merchants, railways and tramways, and other important users of engineering plant and materials, both at home and overseas.

Dissolutions and Liquidations.—Edison Manufacturing Co., Ltd.—Meeting February 6th, at 164, Wardour Street, London, W. 1, to hear an account of the winding up from the Liquidator, Mr. A. F. Wagner.

H. R. Latham & Co., electrical and general engineers, 16-18, Vauxhall Road, Liverpool.—Messrs. H. R. Latham & F. Wilde have dissolved partnership as from June 25th, 1917. Debts will be attended to by Mr. H. R. Latham, who will continue as general engineer at the above address. Mr. Wilde will carry on business as the Liverpool Electrical Engineering Co., at 20, Vauxhall Road, Liverpool.

Adams, Beardsall & Co., electrical fittings manufacturers, East Stanley Street, Salford, and Manchester.—Messrs. F. W. Adams & W. E. Beardsall have dissolved partnership. Mr. Adams attends to debts, &c.

Carson & Evans, 121a, Bunhill Row, London, E.C. 1.—Messrs. F. M. Carson & T. Wozencroft Evans have dissolved partnership. Mr. Carson will continue the business as F. M. Carson, and will attend to debts.

W. C. Tackley & Co., Ltd.—Meeting called for February 2nd at the High Street, Croydon, to hear an account of the winding up from the Liquidator.

Drum Engineering Co., Bradford, engineers and pump manufacturers.—Messrs. W. I. & C. E. Johnson have dissolved partnership. Mr. C. E. Johnson will attend to debts and continue the business.

Electrical Firms and the Royal Arms.—The following electrical firms are included in the list just published in the *London Gazette* of concerns having authority to use the Royal Arms by reason of their holding warrants of appointment to H.M. the King:—Edison Swan Electric Co., Ltd., the Hart Accumulator Co., Ltd., Messrs. A. P. Lundberg & Sons, Messrs. Burt, Escaré & Denelle, Ltd. (electric fittings and bronze manufacturers), and Messrs. Perry & Co., Ltd. Messrs. Tasker, Sons and Co., telephonic and electrical engineers, Sheffield, have also the right to use the Arms under a warrant of appointment from the late Queen Victoria.

Book Notices.—The Christmas number of the *M. and C. Apprentices' Magazine* is quite a thick volume, and contains a wide variety of reading matter. A portrait of Mr. Henry A. Mavor is accompanied by an extremely interesting and well-written biographical sketch of this versatile and talented pioneer in electricity supply and the electric propulsion of ships. Mr. W. W. Lackie, an old apprentice of the firm, contributes an article containing excellent advice to apprentices; as for the rest of the contents, including the numerous illustrations, we can only say that there is something for everybody, and the whole deserves the highest commendation.

A new publication of the U.S. Bureau of Standards (Circular No. 68), entitled "Public Utility Service Standards of Quality and Safety," contains a brief outline of the public service activities of the Bureau, together with lists of the publications bearing on the various subjects which have been issued by the Bureau. The sub-headings giving the public service activities are:—Standards for Electric Service, Standards for Gas Service, Standard Methods of Gas Testing, National Electric Safety Code, Electrolysis Mitigation, Further Activities. Those interested may obtain a copy by addressing a request to the Bureau, at Washington, U.S.A.

The Electrical Engineer's Diary, 1918 (S. Davis & Co. Price 6s.), which is now in its tenth year, contains a large amount of new information, and is really quite an encyclopædia of engineering, containing sections on the generation of electricity, its uses for motive power, lighting, cooking, and heating, and the installation of telephones and bells, as well as official rules and regulations, a useful list of London streets in which mains are laid, and a table of electricity supply authorities in the United Kingdom. The range covered by its contents is extraordinarily wide, and it is well printed on good paper, the sections being distinguished by different colours. The diary portion contains eight days to an opening, affording ample room for notes, and sectional ruled paper is used for this part. An edition bound in limp covers, without the memorandum pages and blotting pad, is also issued.

Calendars and Diaries.—Messrs. Thermit, Ltd., of 675, Commercial Road, Limehouse, London, E. 14, have sent us, as usual, one of their pocket calendars and note-books for the year. "Thermit" welding information is given in the opening pages.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, E.C. 4, have prepared for their friends, and for any reader who writes in, sending his trade card, or applies to one of the company's branch organisations, the Wotan pencil economiser; a useful pocket novelty closely resembling a fountain pen in appearance, and enabling any pencil to be used up to the last ½ in. It is provided with a split-tapered bush to accommodate pencils of varying thicknesses, &c. This little article reminds the writer to "Use Wotan Lamps for Economy."

Messrs. Alfred Herbert, Ltd., of Coventry, have issued their 1918 calendar in the same size but in slightly different style from that of the art paper calendars of recent years. The covering page gives a view of Ford's Hospital at Coventry, and the rest consists of boldly-printed monthly date sheets, the upper half of which is occupied by a view of the firm's works or the equipment therein.

Catalogues.—British Thomson-Houston Co., Ltd., Rugby.—Twelve-page descriptive list (No. 4,221), describing their automatic circuit-breakers for a.c. and d.c. circuits. The list is fully illustrated, and, as usual, contains tabulated dimensions, dimension drawings, and shipping specifications.

Messrs. C. A. Vandervell & Co., Ltd., Acton, W. 3.—January moon chart for postcard service.

Commercial Libraries.—At a meeting of the Birmingham City Council, on Tuesday, it was decided to establish a Commercial Library, and to proceed with the necessary work at an estimated cost of £1,500. The library will contain British, Colonial, and foreign directories; telegraph codes; maps; annuals relating to various countries; Consular reports; and books on commercial law, accountancy, business methods, and organisation.

British Industries Fair, 1918.—As it is possible that the new accommodation for the British Industries Fair (Glasgow), 1918, may not be entirely completed by February 25th, and as it is of great importance that the British Industries Fairs in London and Glasgow should be held simultaneously, the Board of Trade have decided to postpone the opening of both Fairs for two weeks. Accordingly the period for which the British Industries Fairs in London and Glasgow will be open will be March 11th to March 22nd.

Bankruptcy.—W. J. Fahn, consulting engineer, Maida Vale.—First and final dividend, 1s. 11½d. in the £.

Trade Announcements.—One of the latest business amalgamations consequent upon the war is the incorporation of Messrs. Whittaker & Co., of White Hart Street, Paternoster Square, E.C., with Sir Isaac Pitman & Sons, Ltd. Messrs. Whittaker, of whose firm Mr. A. J. Rayment is the sole surviving partner, the other having given his life for his country, have long been known as publishers of scientific and technical books, and their catalogue contains many important electrical works. Messrs. Pitman will enjoy the benefit of Mr. Rayment's experience and his knowledge of what is required by scientific and technical students, as he intends to direct from their offices the new department thus added to their undertakings.

The name of the Oliver Arc Lamp, Ltd., has been changed to the "Oliver-Pell" Electric and Manufacturing Co., Ltd.

LIGHTING AND POWER NOTES.

Aberystwyth.—E.L. Scheme.—Mr. Carrington, of the Rheidol Lead Mines, has submitted an electric light scheme to the T.C. It is proposed to erect a power station in the Rheidol Valley close to the mines, and supply current to the town. The T.C. has appointed a Committee to visit the site and report on the scheme.

Bedford.—The T.C. has disposed of the old plant in No. 1 engine room at the electricity works to Mr. P. Stanton for £300.

Belfast.—The resolution of the Corporation authorising the Tramways and Electricity Committee to take the necessary steps to give effect to the recommendations of Sir John Snell, including the application for the sanction of the L.G.B. to the provision of £60,000 for equipment for the electricity station, was the subject of severe strictures at the meeting on the 2nd inst. Councillor Alexander attacked the proposal, objecting to the expenditure of so large a sum of money under the present management. Alderman Tyrrell said the expenditure arose out of the breakdown of No. 10 turbo-generator. Arrangements were nearly complete for the installation of a new 5,000-kw. set.

At the local Munitions Tribunal recently, the Corporation proceeded against 97 men of the electricity department for having taken part in a strike in connection with a difference as to the rate of wages, in contravention of the Munitions Act. It was reported to the Court that the men had returned to work, and leave was asked to withdraw the summons, which was granted.

Birmingham.—The City Council has adopted a report of the Labour Committee granting to all employés of the Corporation a further war advance in wages. A proposal was approved altering the general instructions of the Council, and appointing a Special Committee for dealing with salaries, so as to avoid the necessity of public discussions on the merits of the principal officials.

Blackburn.—Proposed New Station.—On the invitation of the Electricity Committee, the chairman and vice-chairman of the Gas Committee have joined a special Sub-Committee of the former body which is considering the question of the necessity of proceeding with the work of construction of a new generating station.

Blackpool.—An additional supply of electricity for light and power is required at the King's Lancashire Military Convalescent Hospital, Squire's Gate, and the Electricity Committee has agreed to lay the new main required on condition that the military authorities will pay one-third of the cost.

Blackrock.—Prov. Order.—The B. of T. has extended the Electric Lighting Order for a further period of one year.

Bradford.—The Electricity Committee recommends that a new generating station be erected on the Esholt estate—a large Corporation estate used in part by the sewage undertaking; the city electrical engineer is to prepare plans and estimates, with a view to application to such Government Departments as may be concerned for sanction to carry out the scheme.

At a mass meeting on Sunday night last, all classes of Corporation employés rejected the proposed Corporation increase in the war bonus. The matter affects between 4.000 and 5,000 workers, and they now ask that the matter shall be referred to arbitration.

Clayton.—Prov. Order.—The District Council is still discussing the future of the electricity supply; at a meeting last week, the Council decided to be tied down to nobody, though it is felt to be quite likely that Clayton will be incorporated in Bradford after the war, and the Council is to apply to the L.G.B. for a prov. order to supply electricity on its own account.

Clyde District.—The Clyde Valley Electrical Power Co. has greatly increased its output during 1917, and the total connections to the company's system are now equivalent to 110,000 h.p. Another 7,000-h.p. turbo-generator has been added at the Clyde Mill station, with considerable additions to the steam-raising plant at Yoker, and it is anticipated that there will be in operation at the latter station by next autumn a 20,000-h.p. turbo-alternator. The average price of power for the past year was ·68d. per unit.

Continental.—Russia.—A recent issue of the *Novoye Vremya* states that for want of fuel the electric lighting of Petrograd has been reduced. The Electric Equipment Co. (formerly "Helios") will deliver current to subscribers between 6 a.m. and 12 midnight only. The Belgian Co. is now delivering current during the night only for street lighting, military headquarters, Council of Workmen's and Soldiers' Delegates, and some town hospitals. It will not supply current to subscribers before 3 p.m. until it receives fresh supplies of fuel. The 1886 company has also reduced its output.

Spain.—The *Times* states that Madrid is now without light owing to want of coal.

Doncaster.—The R.D.C., last week, decided to oppose the new Bill of the Yorkshire Electric Power Co.

Dublin.—The Electricity Committee has recommended a further increase in price for lighting of ½d. per unit, and of ¼d. per unit for power. The Committee pointed out that the deficit last year was £1,575, but that there had been a net loss of income on premises destroyed during the rebellion of £6,018. The exceptional expenditure due to the war included £10,085 extra for coal. Increased charges brought in an extra income of £13,293, leaving a balance of £12,886, which, with the exception of £1,575 deficit, was made up by improved business. The Committee has made certain representations to the Council in regard to the Council's attitude to the electricity undertaking, and asks that the Council will confer on it emergency powers to enable it to take the necessary steps for the maintenance of supply during the war, otherwise it declines responsibility for the conduct of the undertaking.

Dulverton.—Workhouse Lighting.—The B. of. G. has decided to have the electric light installed at the workhouse, at a cost of £35 for 25 lights.

Elland.—Proposed Loan.—The Council has instructed the clerk to take the necessary measures with a view to borrowing £2,000 for electricity extensions, and has approved an advance in wages of all regular Council workmen to 15s. above pre-war rates.

Gillingham (Kent).—Price Increase.—The T.C. has decided to further advance the price of current for lighting by 10 per cent., a total increase since the war began of 50 per cent., and for all other purposes by 20 per cent., a total increase of 60 per cent., as from the meter readings taken at the end of December last.

Halifax.—Price Increase.—At the T.C. meeting, the Electricity Committee proposed an increase in charges for lighting and heating of 12½ per cent. and of 20 per cent. to power consumers not under agreement. In moving that the recommendation be referred back, Councillor Swaine urged that the cost was little more than 1d. per unit, but the lighting consumers were charged 4d., and instead of rushing up the price, it would be better to give facilities for introducing electricity into as many homes as possible. If there was any increase, it should be for power only. Alderman Spencer, replying to a discussion, said the increase was modest in proportion to the increased costs. The lighting consumption was only 1,400,000 units out of a total of 16,704,000. The amendment was defeated and the recommendation approved.

Lancashire Electricity Suppliers and Coal.—It was reported on Tuesday in Manchester that many municipal Electricity Committees in East, Central, and South-East Lancashire intend backing up the Salford Town Council in its protest to the Coal Controller against the last increase of 2s. 6d. per ton in coal prices. The imposition is deeply resented in Lancashire municipal and industrial circles.

Leeds.—Extensions.—At a meeting of the City Council, last week, it was announced that, as a result of the Ministry of Munitions, sanctioning the purchase of a 6,000-kw. turbo-alternator, but declining sanction to the big extension scheme, the work which may proceed includes the removal of two 15-year old 1,400-kw. machines and the substitution of the one sanctioned. The work will cost about £35,000, and it is hoped it will be completed in time for next winter's demand.

London.—Hackney.—The Electricity Committee has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., and has requested the Finance Committee to take the necessary steps to procure a loan of £40,000 for the purchase of the machinery, &c., as follows:—7,500 k.v.a. turbo-alternator and auxiliary plant, £32,395; foundations and platforms, £1,500; pipework and cablework, £1,500; switchgear, £1,102; contingencies, £3,503.

Manchester.—At the last meeting of the Finance Committee, the city treasurer was authorised to borrow £20,000, repayable within 25 years, for purposes of the electricity undertaking.

The Electricity Committee has recommended the Council to grant to the adult male skilled and unskilled employés in the electricity department a further bonus of 5s. per week recently awarded by the Committee on Production, and recommended that the question of whether or not the semi-skilled and unskilled employés in the department are entitled to receive the bonus of 12½ per cent. recently granted to certain engineers, be referred to the Ministry of Munitions to determine.

Marsden.—E.L. Proposals.—The D.C. has considered the Yorkshire Electric Power Co.'s request for comments on, or amendments to, the prospective Bill in Parliament, and considers that it should retain freedom of action with regard to any supply of electricity to the district, and the clerk was instructed to reply accordingly.

Middleton (Lancs.).—Increased Charges.—At the last meeting of the T.C., a letter was read from the Manchester authorities with reference to the proposal to make increased charges for bulk supply of electricity taken from them. The Middleton Council has decided to increase the charges for electricity for power and lighting purposes to consumers by 12½ per cent. from January 1st last.

Monasterevan.—The Local Land and Labour Association has passed a resolution pledging its support to Mr. Griffith, of the Monasterevan Electric Co., in connection with the electric lighting of the town.

Nelson.—A Sub-Committee appointed to consider the second report of the Committee on Inter-Communication of Lancashire and Cheshire Electricity Supply systems, has passed a resolution agreeing generally with the proposal to link-up the electricity undertakings, but not with the second portion of the report proposing the conferment of additional powers upon a proposed joint board in regard to the establishment and control of future and existing power stations and high-pressure transmission lines.

Rochdale.—The T.C. has expressed its high appreciation of the generous action of Messrs. Thomas Robinson & Son, in voluntarily agreeing to annul a clause in their electricity contract made with the Corporation before the war, and to substitute the Committee's new scale of charges from April 1st next to March next year. It was stated that this would mean a difference of £800 to the Corporation per year.

Salford.—Loan Application.—Application is to be made to the L.G.B. for permission to borrow £1,000 for land for electricity premises, and £6,200 for mains and services.

Sheffield.—Loan Sanction.—The town clerk reports receipt of sanction to the borrowing by the Corporation of £602,000 in connection with the proposed electric power station at Blackburn Meadows.

Linking-up.—At a meeting of the Electricity Supply Committee it was reported that a further meeting of the Joint Sub-Committee with reference to electricity supply to Sheffield, Rotherham, and other adjacent areas had been held, when certain terms were approved in connection with the proposed linking-up scheme between Sheffield and Rotherham; such terms provide that the total cost of cables and transformers, together with suitable metering arrangements, estimated at £50,000, should be apportioned equally between the two Corporations, and that the maintenance of the inter-connecting arrangements should be undertaken by either Corporation, as may be agreed, the cost being apportioned equally between them, and that the supply should be available as may be agreed between the respective engineers. It is proposed that all points of difference arising out of the proposed agreement be referred to arbitration. It is also proposed to make an application to the Ministry of Munitions for a free grant of a portion of the total cost of, and incidental to, the linking-up arrangements; Mr. Gridley, on behalf of the Ministry of Munitions, has suggested that two sets of 20,000 to 25,000 kw. should be placed on order, one for Blackburn Meadows station, and the question as to the allocation of the second set not to be definitely settled at the moment. It is understood that the cost of the scheme will be approximately £1,000,000. The Electric Supply Committee approved the proposed terms.

Silsden (Yorks.).—The Council, last week, considered the Yorkshire Electric Power Co.'s new Bill, but in view of the recommendations of the Government Reconstruction Committee in regard to national electricity supply, the Council left the matter over until the February meeting.

Stafford.—The Corporation has issued a special appeal to the residents to exercise the strictest economy in the use of electricity.

Swansea.—The Chairman of the Electricity Committee stated that the sanction of the Government had been obtained to the extension scheme in connection with the electricity plant, for the purpose of supplying the docks, &c.; the sanction had been given on priority, and he considered this an indication of the importance attached by the Government to the Swansea scheme and its probable scope in regard to the proposed new provisions for combination of electric light undertakings.

Weston-super-Mare.—Price Increase.—The Electric Supply Co. has given consumers notice that the price of energy for lighting has been increased by ½d. per unit, and for heating and power by ¼d. per unit.

Worcester.—At the City Council meeting, Mr. W. J. Hill referred to the report of the Coal Conservation Sub-Committee, and expressed the view that Worcester was not likely to be affected by the national scheme for many years. The Council accepted a recommendation to install new pumps and machinery at the waterworks and to utilise electricity more for pumping. A sum of £750 will be contributed by the electricity department towards the cost of cable, transformers, switchgear, and buildings, &c. There would be a guaranteed minimum demand of 400,000 units per year.

Yeadon.—The Council has decided to deal in Committee with the Yorkshire Electric Power Co.'s prospective new Bill in Parliament, along with a Bill by a local gas company.

Yorks. (West Riding).—The Law and Parliamentary Committee of the West Riding County Council recommends the Council, that unless satisfactory clauses or amendments are introduced, the Bill being promoted by the Yorkshire Electric Power Co., Bills by the Rotherham and Sheffield Corporations, and Lighting Orders asked for by the Sheffield and Halifax Corporations and the Guiseley, Clayton, and Queensbury District Councils shall be opposed in Parliament.

TRAMWAY AND RAILWAY NOTES.

Ashton.—Tramway Purchase.—Owing to the war, it has not been found possible by the Ashton Corporation to carry out the purchase of the Oldham, Ashton, and Hyde Electric Tramways. An application, however, is now to be made to the B. of T. for an extension of one year on the period of 21 years, at the expiration of which the municipal authorities were empowered to acquire the company's undertaking.

Birmingham.—A scheme is being formulated by which it is hoped to carry goods on a rather extensive scale on the tramways. The object is to reduce the number of horses and mechanically driven vehicles employed in the city in connection with the retail trades, having regard to the shortage of provender and petrol.

The debate was resumed on Tuesday, at a meeting of the City Council, on the important report of the Public Works Committee, which made drastic proposals for the substantial widening of the chief main arterial roads. The width proposed is 120 ft., and it is proposed to adopt a separate sleeper track for tramways. The scheme would be carried out over a long period of years, authority being given to the Public Works Committee to buy up building frontages and sites of premises as leases fell in. Street widenings had hitherto been of a piecemeal character. Mr. Neville Chamberlain expressed the view that tramways laid in macadam roads were doomed, and that there would be an enormous development of sleeper track tramways, which were in reality light railways, for passenger and goods traffic. The scheme was approved.

Halifax.—The T.C., last week, sent back for further consideration, the War Wages Committee's resolution viewing with alarm the continual demands of labour for more wages, and urging the Government to take measures to put a time limit on the possibility of further applications after advances have been granted.

Fare Revision.—The T.C., after considering tramway fares in Committee, has instructed the town clerk to ask the Tramways Control Board to urge the Government to empower local tramway authorities to increase their fares beyond the limits prescribed by the local Acts, with a minimum charge of 1½d. The resolution further provided that in the event of such powers being obtained, the Halifax fares be increased by 50 per cent., except those of children and of the stage between the Post Office and railway station. It is proposed, under this idea, to issue tickets to children on the lines of workmen's tickets. The fare from the Post Office to the railway station is to be increased from ½d. to 1d. as from January 7th, the transfer system is to be abolished, and the West End circular route is to be discontinued. The Council further decided to ask the B. of T. for power to increase the motor-'bus fares.

Oldham.—The Tramways Committee was last week empowered to purchase a new electrical 'bus for the Coppice Post Office service. Councillor Cheetham said their history of 'buses had been unfortunate. They had never been profit-earning, and during the past 12 months they had disposed of two out of their three 'buses. The objection to the remaining one was not that it was gas-driven; in other towns electrical 'buses were satisfactory, and they had their own experience of an electrically-driven tower wagon, on which, reckoning electrical energy at 1½d. per unit, the cost of running was 1·4d. per mile.

South Africa.—According to the *British South African Export Gazette*, Sir William Hoy says that the electrification of the S.A. railways is a question which his department intends to tackle seriously. The Johannesburg-Durban line may receive first attention.

Wigan.—Accident Inquiry.—At the adjourned inquest on the two victims of the runaway car accident at Pemberton, the driver of the car said he noticed a defect in the hand-brake before the accident. When the trolley was being changed, the car commenced to run back; he called to the conductress to replace the trolley, so as to make the magnetic brake available, but she failed, and in the scuffle he dropped his power handle. Fearing a collision, he jumped from the car. He admitted there were two other brakes he might have used, and knew that he was taking a risk in continuing the journey after finding the brake was defective, but thought he could control the car. The jury returned a verdict of "Accidental death," adding that in their opinion the driver was deserving of censure for not using more discretion. They also recommended that in future conductors and conductresses should be instructed not to remove the trolley pole until told to do so by the driver. The Coroner remarked that there seemed no doubt that had the motorman stuck to his post he might have been able to save the two lives.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd. Rosario Municipality Establishment of telephone service within the municipal radius Conditions on application.

Australia.—Melbourne.—April 5th. Department o the Navy. Motor-driven hydraulic pump. Director of Nav Contracts, Melbourne.

Bolton.—January 15th. Electricity Committee. On 7,500-kw. turbo-alternator with condensing plant. See "Offici Notices" December 7th.

Manchester.—January 16th. Electricity Committee. Rotary converter or motor converter plant. See "Official Notices" December 28th.

February 2nd. Waterworks department. Electrically-driven radial arm crane. See "Official Notices" January 4th.

Spain.—The municipal authorities of Astilleros (Province of Santander) have lately invited tenders for the concession for the electric lighting of the town during a period of four years. Tenders have also been invited for the concession for the electric lighting of the town of Albaida (Province of Valencia).

Tipperary.—January 11th. New battery for the Union electric lighting plant. See "Official Notices" December 21st.

CLOSED.

Bolton.—Tramways Committee. Aron Electricity Meter, Ltd. Additional meter at the Spa Road generating station for measuring energy for tramway purposes.

Glasgow.—Tramways Committee :—

Dyes & Young.—Commutators.
Micanite & Insulators Co., Ltd.—Leatheroid.

Leeds.—Electricity Committee. 6,000-KW. turbo-generator: Richardsons, Westgarth & Co.

London.—Hackney.—B.C. Electricity Committee. Accepted tender: —One 7,500-K.V.A. turbo-alternator and auxiliary plant, £32,395: Messrs. C. A. Parsons & Co., Ltd.

Salford.—Town Council. British Westinghouse Electric and Manufacturing Co., Ltd., 300-K.V.A. transformer, at £380, and an E.H.T. switch cubicle, at £265.

Sheffield.—City Council. Electricity and Tramway Departments :—

E. Taylor Ltd.—Construction of penstock and flushing chamber.
Wellerman Bros.—Erection of sub-station Upwell Street, £450.
S. F. Bowser & Co.—Oil storage and measuring system, together with pumps, piping, &c., £445.

Watford.—U.D.C. :—

Brush Electrical Engineering Co., Ltd.—Turbo-alternator, £8,980.
Stirling Boiler Co.—Boiler, £1,750.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 11th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber), Smoking concert.

Junior Institution of Engineers.—Friday, January 11th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Construction of Post-War Aeroplanes," by Mr. F. W. Halliwell.

London Association of Foremen Engineers.—Saturday, January 12th. At 7 p.m. At Cannon Street Hotel, E.C. Presidential address by Mr. R. M. Campbell.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, January 12th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Cable Complaints," by Mr. J. H. C. Brooking.

Birmingham and District Electric Club.—Saturday, January 12th. At 7 p.m. At the Swan Hotel, New Street. Presidential Address by Mr. J. J. Richardson.

Institution of Electrical Engineers.—(Manchester Local Section).—Tuesday, January 15th. At 7 p.m. At the Engineers' Club. Paper on "Electrical Signalling and Control on Railways," by Mr. C. M. Jacob.

Illuminating Engineering Society.—Tuesday, January 15th. At 5 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Ten Years of Illuminating Engineering," by Mr. L. Gaster.

Greenock Electrical Society.—Tuesday, January 15th. At 7 30 p.m. Visit to Glebe Sugar Refinery.

Belfast Association of Engineers.—Thursday, January 17th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Past, Present and Future of the Internal-Combustion Engine," by Prof. J. H. Smith.

Institution of Mechanical Engineers.—Friday, January 18th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Papers on "Traction on Bad Roads or Land," by Mr. L. A. Legros, and "Utility of Motor Tractors for Tillage Purposes," by Mr. A. Amos.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the Electrical Review, which is now printing, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Electrical Trade with Siberia.—In the course of an article on "Industrial Opportunities in Siberia," published in *Russia*, Mr. C. W. Purington says:—In my various trips through the Siberian communities I have frequently inspected small steam and electric installations, and have found the electric ones, almost without exception, of German manufacture; while the steam units are usually of the German locomobile type. In the city of Vladivostock a large and handsome building stands facing the harbour on one of the main streets. The entire building was occupied by a great electrical firm of Berlin. From this office the company directed, not only the civil installations throughout the Primorsk or coast province of Siberia, but also the principal electric installations of the Russian Government. In order to install a 450-KW. American generator at Nikolaievsk in 1910, special permission was necessary from a firm of German manufacturers. Is this incident likely to be repeated? I think not. The building of that German company to which I refer is, I have no doubt, boarded up as tight as the German Embassy at Petrograd, and the German staff of the company are in safe keeping until the close of the war.

I can give one example of the former use of German electric machinery by a gold-mining company using some 20 generators and over 100 electric motors for mining purposes, in connection with five hydro-electric plants that are almost exclusively of German manufacture. This company has now decided not to purchase another pound of German machinery of any shape or description. Centrifugal pumps, direct-acting pumps, hoists, electric and steam industrial locomotives, excavating and conveying machinery are subject to the same comment. Fuse caps, quicksilver, special steels, tools of all descriptions have been for years purchased by the Siberian gold-mining companies from Germany. The Russians say: "Never again."

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending January 19th, 1918, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer of the Week.—Second Lieut. H. J. Golding.

Monday, January 14th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 15th.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, January 16th.—No. 1 Company, Drill, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, January 17th.—No. 2 Company, Drill, Knotting, &c., 6—8. Recruits' 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, January 18th.—Musketry, 6.30—8.

Saturday, January 19th.—Entrenchments, &c., 2.45—4.45. Recruits' Drill, 2.45—4.45.

Special Notices.—All drills and parades will be at Headquarters unless otherwise stated.

Recruits will attend for Engineering Instruction with the Companies.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Electric Steel.—The London Foundry Co., Ltd., whose works are near Enfield, with one electric furnace at work, in five months made a net profit of £9,200; but the rate of profit in the fifth month was more than double that in the first month, and it is estimated that with two additional furnaces in operation a net profit of £60,000 a year will be attained. The company makes high-class steel and steel alloys, mostly nickel steel, nickel chrome steel, and high-carbon tool steel. from scrap steel. In addition to the foregoing products, the whole of which are required for war purposes, steel wheels and other castings for motor lorries are made.

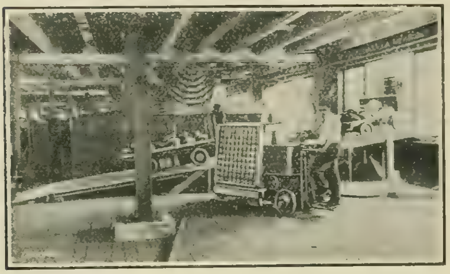
In view of the pressing demand for the company's products, every effort is being made to complete extensions to the works, and within a few months. with three furnaces each of 3 tons capacity, and new generating and foundry plant, the output of the works will be 600 tons of steel per month. The orders in hand are said to be sufficient to keep the present plant working at its maximum output day and night till next August.

An article by Mr. John A. Holden in the *Iron and Coal Trades Review* states that a few years ago steel turnings could be bought for 30s. per ton; the price to-day for the same metal is about £4 per ton, the raw material for the manufacture of electric steel in the arc type of furnace consisting almost entirely of turnings. Fifty 3-ton electric furnaces would consume annually 150,000 tons of steel turnings. For producing electric carbon tool steel, mild-steel turnings from shells are in much demand. Nickel-steel turnings are used for the manufacture of nickel-steel ingots. With a suitable grade of scrap no addition of nickel may be required, because in any type of electric furnace there is no oxidisation of nickel. Similarly, nickel-chrome-steel turnings may be profitably converted into nickel-chrome-steel ingots. In acid-lined furnaces there is little or no loss of chromium; in fact, the reactions in this furnace are comparable to those of the crucible process. In basic-lined furnaces chromium may be retained or eliminated. In the former case the phosphorus would not be so completely oxidised, but, nevertheless, it would be confined to safe limits. It follows that for the cheap production of alloy steels, such as nickel and nickel-chromium, scrap turnings containing the necessary elements should be used.

From an economic point of view, it is undesirable that alloy-steel turnings should be used in charges where the alloying elements are not necessary or desirable. Many engineering establishments do not keep all these varieties of scrap separate. Fifty tons of 3 per cent. nickel-steel scrap contain £300 worth of nickel. Taking 50 tons as a weekly average, it represents potentially £15,000 per annum.

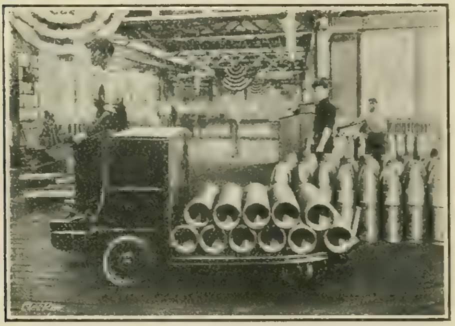
Electric Industrial Trucks.—Statistics prove that the electric industrial truck can replace from three to five men, who are thus released for meeting unusual demands for men and more men, and these economic units also show an increase in the handling speed.

New uses for the industrial truck are constantly being found. Several years ago the U.S. Government adopted them for use in its arsenals, and following England's precedent, practically all the factories making munitions are now using these "electrics," and are finding them indispensable. Some manufacturers use conveyors, but the munition men found that the storage battery truck met their requirements much more suitably, first, because the electric industrial truck could do all and more than a conveyor at a much less cost; secondly, because there was the danger of friction with conveyors; and thirdly, because trucks are more mobile. Special models have been designed with separate compartments for the transportation of shrapnel and other shell, and large numbers of these trucks are being operated by women.



Industrial Trucks Carrying 4,000-lb. Loads up Incline.

The trucks are made small enough to operate in the aisles of factories and storage warehouses, to run on elevators and into freight cars, yet their standard capacity is two tons. Many of them carry loads up to 20,000 lb., and can climb grades too steep for hand trucks. Elevating transfer trucks have also been developed which can pick up, carry away, and set down loaded interchangeable platforms, thus eliminating hand labour in loading and unloading the trucks.



Electric Industrial Truck in American Factory.

A prominent petrol car company has a fleet of 49 electric industrial trucks, and in its plant, which covers about 110 acres of floor space, the average hauls are 150 ft., and these little trucks successfully pull loads up 12 per cent. grades. The entire fleet is housed in an 80 × 80 ft. garage. The operating record of a two-ton truck was kept during one month, and the average cost per ton-mile was :—Labour, \$2·040; power, \$·066; maintenance, \$·010; investment and depreciation, \$·017, making a total cost per ton-mile of \$2·133. This truck averaged 3·7 miles per day loaded, plus the same mileage empty, and its average daily total tonnage was 14·1. A single example of the labour saving effected in one department of this plant plainly proves the economy of the industrial truck. Eighteen men were formerly needed to unload storage batteries from freight cars; eight men with one electric industrial truck now do the same work, and do it faster.

British Electrical Propaganda.—The British Electrical and Allied Manufacturers' Association has issued two special issues of the B.E.A.M.A. *Journal* for propaganda purposes in Spain and Russia on behalf of British manufacturers. They contain articles calculated to impress readers in these two countries with the ability of our electrical manufacturers to cater for the electrical requirements of Russian and Spanish-speaking purchasers. In addition to special articles on such subjects as railway electrification and textile factory installation work carried out by British engineers, there are numerous illustrated notices of machinery and apparatus manufactured by B.E.A.M.A. members. We hope that the circulation of literature of this description will help to strengthen the position of our firms abroad at the present important stage of our history.

The Position in Spain.—A correspondent in Spain writes :—The shortage of coal is causing serious trouble to many supply companies. For the past month the "Compania Sevillana de Electricidad," of Seville, has received only half the quantity necessary for the normal output, and many factories in the district were shut down for lack of motive power. Rioting of the unemployed workmen followed, and an attack was made on the power house, resulting in nothing more serious than broken windows. An arrangement has now been come to, the consumption of energy for lighting purposes being restricted to certain hours, and the coal thus saved is being used for the day power load.

In order to prevent shortage of current in the mines of Murcia and in other industries employing thousands of workmen, the "Sociedad Hidro-Electrica de Espana" has been ordered by the Government Commission of Supply to refuse public supply between the hours of mid-day and 2 p.m. at its steam-driven power houses in the provinces of Murcia, Madrid, Valencia, and Alicante. For the same reason the tramway services in Madrid and Valencia are to be stopped between 1 a.m. and 6 a.m.

In La Union (near Cartagena) the merchants have sent a petition to the supply company demanding an efficient supply of current within two days, failing which they will shut down their factories and close their shops, will organise a procession in the streets, and will, further, refuse to pay accounts for energy supplied.

Electrical Resistivities of Iron Alloys.—A recent article by Mr. T. S. Fuller, of the Research Laboratory of the General Electric Co. (U.S.A.), in the *General Electric Review*, contains some interesting data on the above subject, obtained from an investigation of the electrical resistivities of a series of iron alloys. Most of these were melted either in an atmosphere of hydrogen or in a vacuum; the component metals used were Swedish iron, Goldsmith chromium and manganese, nickel, and cobalt, 98-99 per cent. pure. Portions of the 100 gramme melts were swaged and drawn down to wire of ·01 in. diameter, and all the alloys mentioned are sufficiently ductile for wire drawing. The samples were annealed, and the resistance measured at room temperature by means of a potentiometer using the null method.

Alloys can be divided into three characteristic groups as regards resistivity; in the first (examples being tin-zinc, tin-lead, tin-cadmium, &c.), the resistivity can be calculated directly from the components, if the concentration by volume is known; in the second group (gold-silver, copper-nickel, iron-nickel, &c.), the alloy resistivity is much greater than that of either of the components. The components of the first group represent a mechanical mixture, in the second group they are in solid solution, in a third group they are present in a semi-miscible state, that is, one in which two series of solid solutions are separated by a gap; examples of this group are copper-silver, copper cobalt, &c. All the systems considered by the author belong to the second group. The iron-nickel alloys range in resistivity from the values for iron and for nickel up to a maximum of 86·3 microhms per cm.^{3} (Fe 66 p.c., Ni 34 p.c.). The alloys containing large amounts of iron are readily oxidised, and should not be used unprotected at temperatures above 400-500° C.

The iron-chromium series presents only a small difference in resistivity for alloys containing 10, 20 and 30 per cent. chromium; the addition of 10 per cent. Cr increases the resistivity five-and-a-half times, and gives a value 32 times the resistivity of copper. The more Cr present the greater the resistance to oxidation at high temperatures; alloys containing 20 per cent. or more of Cr may be safely used up to 800° C. Alloys containing 80 p.c. Fe and 20 p.c. Cr, and 78 p.c. Fe and 22 p.c. Cr, have a resistivity of 60 microhms per cm^3.

The addition of about 30 per cent. of cobalt to iron about doubles the resistivity: like the iron-nickel series, the iron-cobalt alloys are readily oxidised at high temperatures, and should not be used above 400-500° C.

Data of the iron nickel-chromium system shows resistivities ranging from 11·8 to 12 microhms per cm.^{3} for nickel and iron individually, to 113 microhms per cm.^{3} (Fe 20 p.c., Ni 55 p.c., Cr 25 p.c., or Fe 10 p.c., Ni 53 p.c., Cr., 37 p.c.), this figure being 66 times the resistivity of copper.

The only alloys of this group which are not highly resistant to high temperature oxidation are those containing large amounts of Fe and less than 20 per cent. of Cr. All others resist oxidation to a high degree. Those alloys containing large amounts of Ni and 20 per cent. or more of Cr are the most resistant to oxidation, and may be used at temperatures up to 1,000° C. Alloys containing up to and including 37 per cent. Cr were made; this is the limit of forgeability. The iron-nickel-manganese alloys have resistivities up to 103 microhms per cm.^{3} (Fe 55 p.c., Ni 36 p.c., Mn 9 p.c., or Fe 53 p.c., Ni 36 p.c., Mn 11 p.c.). These alloys are readily oxidised at high temperatures, and should not be used above red heat.

What has been said of the iron-nickel-chromium system applies equally well to the iron-nickel-chromium-manganese alloys. Those having a high nickel and chromium content are resistant to oxidation at high temperatures, and may be safely used up to 1,000° C. Resistivities of 111 microhms per cm.^{3} are obtained with Fe 42 p.c., Ni 39 p.c., Cr 16 p.c., Mn. 3 p.c., or Fe 34 p.c., Ni 50 p.c., Cr 10 p.c., Mn 6 p.c.

Six tables, showing the resistivity of alloys of varying composition, are included in the article.

An Investigation of Air Pumps.—The important departure by the North-East Coast Institution of Engineers and Shipbuilders in appointing a Committee of expert engineers to test apparatus offered by manufacturers and accepted by the Council has resulted in a very comprehensive report on the working of air pumps, such as are used in connection with the condenser plant of steam engines. The manufacturers in this case were Messrs. Richardsons, Westgarth & Co., Ltd., and the tests were carried out at their Hartlepool works.

The investigations undertaken by the Institution will include air pumps of the reciprocating type and of the rotary and jet types. The present report deals with tests made on pumps of the reciprocating type only, and the point of chief technical interest is the fact that the tests have demonstrated that remarkable influence in the withdrawal of air from a condenser is possessed by a steam jet, or a series of jets, when used in combination with such pumps.

The original conception of combining a steam jet with an air pump was due to Mr. James Atkinson, of London, who in 1886 proposed it in connection with the cooling of liquids under high vacuum. In 1902 it was developed by Sir Charles Parsons in his vacuum augmentor for use with steam engine condensers, and at later dates it has been further considerably improved by Mr. D. B. Morison, of Hartlepool. These improvements, known as the Kinetic system, are dealt with in the report, together with the "wet and dry" and other systems now in general use.

The report demonstrates beyond question that no mechanical contrivance is so simple and so efficient as a steam jet for compressing a large volume of highly attenuated air through a small degree of compression, and, as is already well known to engineers, a reciprocating air pump is a very efficient means for discharging moderate volumes under a high degree of compression. Consequently, the correct solution of the problem of air discharge from a condenser is to withdraw a large volume of aerated vapour by means of one or more steam jets, and compress it through the range of compression in which the steam jet works with very high economy, and then pass it on at such an absolute pressure that an air pump or other device can discharge it to the atmosphere also with very high economy.

The report shows that for a given duty the employment of a steam jet on the Kinetic system will allow the speed of a given pump to be reduced from 60 strokes per minute to 20, and the consumption of steam to be reduced by one-third, the pump mechanism remaining exactly as at present. Alternatively and obviously, an independently driven pump may be made smaller for a given duty.

Restricting Shop Lighting.—The first order has just been issued under the new Defence of the Realm Regulation which empowers the Minister of Munitions to restrict the use of any form of artificial light. On the ground that "it has become necessary for the maintenance of the supply of power for the production, repair, and transport of war material and for other work necessary for the successful prosecution of the war to restrict the use of lights for certain purposes in the area," Mr. Churchill has decided that in the County Borough of Derby no light shall be used in any shop front on any week day, other than Saturday, after 3.30 p.m. or during any period of abnormal darkness occurring at an earlier hour. The prohibition does not extend to any light approved by the chief officer of police as necessary for the serving of customers inside a shop, or to any light used solely for illuminating a small sign in a shop front to indicate to persons outside that the shop is open for the serving of customers.—*Daily Telegraph.*

Electrical Workers' Bonus.—Toward the end of last week it was noised abroad in London that a strike of electrical workers in the metropolis was imminent. It appears from the newspaper Press reports that the Electrical Trades Union held a meeting in London on Thursday, January 3rd, at which expression was given to the feelings of discontent that existed because their members had not received the 12½ per cent. war bonus that had been granted to the great majority of workers in the controlled establishments several months ago. There were threats of a strike unless the advance were conceded by the Ministry of Munitions. In the course of Saturday Sir George Askwith got into touch with the Union, and proposed that the men should remain at work on the understanding that there should be a conference on the matter on Monday. The trouble involved electrical workers in power stations and newspaper and other offices, as well as controlled establishments. The conference duly took place on Monday. In an interview which a *Daily Mail* representative had with Mr. W. J. Webb, the District Secretary of the Union, that gentleman remarked:—"This 12½ per cent. bonus has caused more trouble in the Labour world than anything else. It has been granted to many of the least indispensable workers in other trades, and refused to highly skilled electrical workers. Labourers and men who sweep floors are getting more money than some of our skilled mechanics." According to a similar interview in the *Times*, the difficulty arose through references to several Committees and the apparent lack of finality. As an instance of the peculiarity of the advanced wages, reference was made to one department where a skilled man was receiving 1s. 2½d. per hour, while a labourer was paid 1s. 3d. per hour and a bonus! The right to the 12½ per cent. advance was claimed in accordance with the Government order of October last affecting wages in the engineering and foundry trades.

The conference on Monday is stated to have lasted eight hours. Sir George Askwith, as Chief Industrial Commissioner, met representatives of the employers and of the Union. According to the *Times*, the conference lasted so long owing to the reluctance of some of the employers to agree to make the payment of the bonus retrospective. In the end the advance was agreed to, and it takes effect as from October 13th last. We are indebted to the *Times* for the following report of the terms of the award:—

"All plain time-working employés in generating stations, substations, and on mains directly concerned in the generation and distribution of electrical energy, including the technical staff, and, in the case of electrical contractors, employés engaged on munitions work, including the technical staff, shall receive a bonus as follows:—

"1. All workers who have received not more than 20s. war advance, the equivalent of 12½ per cent. on earnings; any advance given by a pending decision of the Committee on Production, or any advance given by agreement or otherwise, equivalent to the advance of 5s. granted by the Committee on Production to certain trades from the first full pay day in December, to be added as a war advance to the advance already given, and to count as part of the earnings from the date of such advance.

"2. All workers who have received over 20s. war advance sufficient to produce the equivalent of the 20s. plus 12½ per cent. on earnings, that is to say, any excess in war advances over 20s., shall merge in the 12½ per cent. on earnings.

"3. Workmen who have received the equivalent of 20s. war advance plus 12½ per cent. on earnings, or more, are not affected by this settlement. In calculating whether 20s. has been received it shall be taken as 20s. for the normal week as recognised in the district.

"4. Basis rates of wages and conditions of labour shall remain as at present until the withdrawal of war wages and war bonuses. This clause is without prejudice to pending negotiations, if any, which may have commenced.

"5. This decision shall take effect as from the beginning of the first full pay the next after October 13th, 1917."

The result was announced on Monday night to a crowded meeting of members which was waiting for the news at the Holborn Town Hall.

Leeds Telephone Service.—The transition of the Leeds telephone service to the automatic system, the preliminary arrangements for which have been in progress for several months past, will be accomplished in a few weeks' time. The actual change will be made almost instantaneously, without any delay or suspension of the service. Mr. T. B. Johnson, the superintending engineer, announces that due notice will be given to subscribers as to the exact moment of the changing over. In a minute's time the old order will be disconnected, and every line in Central Leeds will be immediately connected to the new system. All numbers will be changed to bring them to a figure exceeding 10000—2873, for instance, becoming 12873. This alteration is to ensure that the initial figure will always signify the same thing, and so set the automatic machinery in running order. In the case of a subscriber having several instruments, where all but one are engaged, the automatic call will come to the disengaged instrument. So far, Leeds is the largest telephone exchange in the world to be converted to the automatic system, the experiments already carried out in London, Portsmouth, Accrington, Epsom, and Hereford all being on a smaller scale. The automatic exchange at Chicago, which is larger than any in this country, was built directly for the system without transfer.

Supplies of Gas Coke in the Metropolitan Area.—Owing to the presence of large stocks of gas coke at London gas works, the Controller of Coal Mines has agreed that any consumer who has already put in some form of requisition for coal or coke under the Household Coal Distribution Order, 1917, may purchase in addition, either directly or through his coal merchant, a supply of coke not exceeding 5 tons, provided that arrangements can be made for delivery before February 1st next. This supply of coke is additional to any quantity included in the allowance under the requisition, and must be gas coke manufactured within the Metropolitan coal area.

Appointments Vacant.—Charge engineer for Bootle Corporation (£150 + war bonus £31 4s.); temporary engineer-in-charge (£3) for the Bermondsey B.C. Electricity Department; assistant engineer, or fitter-driver, for the Sale U.D.C. Electricity Works; charge engineer for the Wakefield Corporation Electricity Department (49s. 6d.); junior shift engineer for Birmingham Corporation (£130 + extras); test room superintendent for the Halifax Borough Electricity Department. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. J. BARCROFT HUDSON, deputy borough electrical engineer, Bootle, was presented with a solid silver tea service and framed photograph of the staff on leaving to take up the position of borough electrical engineer and manager at Leigh. The presentation was made by Mr. T. Dawson Clothier, the borough electrical engineer.

Mr. J. A. VICE, shift engineer at the Manchester Corporation's city electrical stations, has been appointed shift engineer at Stuart Street station at £240 per annum.

Bedford T.C. has appointed Mr. A. H. BULLEN, of Stoke-on-Trent, as mains superintendent, out of 20 applicants.

St. Helens T.C. has advanced the salary of the electrical engineer, Mr. E. M. HOLLINGSWORTH, from £550 to £575 a year, as from November 1st last, with a further advance of £25 from November 1st next; and that of Mr. H. C. DUNCAN, commercial assistant at the electricity works, from £150 to £175 a year, from April 1st next.

The Manchester City Council had before it on Wednesday last week a resolution of the Tramways Committee, sanctioning the transfer of Mr. J. M. McELROY, the general manager of the tramways department, from the Admiralty to the Board of Trade, so as to enable him to serve on the committee of tramway experts recently appointed by the Board, and that the request of the Admiralty that they may be permitted occasionally to utilise Mr. McElroy's services for special work in connection with the department in which he has been serving be acceded to, it being understood that Mr. McElroy will attend in Manchester to all matters of special importance arising in connection with the work of the Tramways Committee.

Mr. C. H. DAVIES, station superintendent to the Stalybridge, Hyde, Mossley and Dukinfield Electricity Board, who recently received an appointment under the Admiralty, was presented with a silver tea service by the electrical staff of the Board before finally relinquishing his duties at Stalybridge last week.

The York E.C. reports that the engineers at the generating station have applied for an increase of wages, and recommends that they be granted £50 each per annum, in addition to war wages and bonus. The Committee explains that the claims of the Army for young men, and the enormous amount of munitions work, have made the demand for trained engineers so great that they are able to command considerably higher salaries than has hitherto been the case. The Committee reports:—"Since the last meeting of the Committee one of the engineers has resigned, and should the Committee be unable to retain an adequate and competent qualified staff the undertaking would cease to be in a position to supply electricity. Apart from the laws of supply and demand, the Committee feels that the charge engineers have specially responsible work at times like these, when air-raid warnings have to be dealt with, and supervision has to be carefully carried out, and they think the Council will realise that the alternative to meeting the request of these officers for an increase of salary must undoubtedly be avoided."

On his resignation from the electrical staff of the Dublin United Tramways Co. (Ringsend power station), Mr. J. P. WALSH has been presented by his colleagues with a gold watch.

Mr. W. M. MILES, analytical chemist to the Sheffield electric supply department, has been permitted to undertake analyses of coal samples for the Coal Control Department, which will pay him an honorarium at the rate of £50 per annum.

General.—The directors of the North British & Mercantile Insurance Co. have appointed Mr. JOHN E. BELL, A.I.E.E., who received his early training at Newcastle Branch, and for some time past has been employed at the company's Edinburgh office as electrical inspector and surveyor, to be second officer at the company's Newcastle branch, with the title of "sub-manager."

The *London Gazette* contains the following announcement:—"Royal Engineers, T.F., Second-Lieutenant to be Lieutenant, H. NIMMO. December 21st, 1917." Lieutenant Nimmo before joining the Army was officiating head of the electrical branch of the Burma Public Works Department. Previously he was with the Rangoon Electric Tramways & Supply Co., Ltd., and the Irrawaddy Flotilla Co., Ltd., of Rangoon.

Mr. L. FRAYNE BOYES, for some time chief outside representative for Scotland for the General Electric Co., Ltd., and well known in Clyde shipbuilding circles, subsequently representing the British General Electric Co., Ltd., of Australasia, in Adelaide, South Australia, is now Investigator and Assistant to Advisers, Priority Permits Branch, New Zealand Munitions Department, Wellington.

The marriage took place at Melmerly Parish Church, on December 29th, of Mr. ROBERT JOHN HALLIBURTON BEATY, A.M.I.E.E., and Miss Edith Westmorland.

Mr. ARTHUR WILLMOTT, A.M.I.E.E., has resigned his position (after 11 years) as works manager of the Electric and Ordnance Accessories Co., Ltd. (Vickers, Ltd.), Birmingham, and is taking up the post of general manager with Messrs. A. A. Lyon & Wrench, Ltd., Victoria Road, Willesden.

War Honours.—We congratulate the following upon the recognition that has been accorded to them in the War Honours List, published on Tuesday last, for their services rendered in connection with the war:—

Order of the British Empire. Knight Commanders (K.B.E.):—

A. J. Dorman, Esq., chairman, Dorman, Long & Co., Ltd.

Lieut.-Col. Henry Fowler, chief mechanical engineer, Midland Railway, and superintendent of the Royal Aircraft Factory, Farnborough.

James McKechnie, Esq., managing director of Vickers, Ltd., Barrow.

Col. A. M. J. Ogilvie, C.B., R.E., Second Secretary to the Post Office.

F. G. P. Preston, Esq., chairman, J. Stone & Co., Ltd.

C. J. Stewart, Esq., Public Trustee.

F. K. Stothert, Esq., West of England Munitions Board.

W. Rowan Thomson, Esq., Director of Auxiliary Ships' Engines, Controller's Department, Admiralty.

Commanders (C.B.E.):—

R. W. Allen, Esq. (W. H. Allen, Son & Co., Bedford).

Major C. J. B. Cooke, chief mechanical engineer, L. & N.-W. Railway.

A. E. Hadley, Esq., Assistant Controller of Inspection of Munitions.

T. R. Marsden, Esq., managing director, Platt Bros. & Co., Oldham.

R. E. L. Maunsell, Esq., mechanical engineer, S. E. & Chatham Railway.

T. Worthington, Esq., late Chief of the Board of Trade Commercial Intelligence Department.

Officers (O.B.E.):—

A. E. Berriman, Esq., chief engineer, Daimler Co., Ltd.

D. A. Bremner, Esq., late Head of the Aluminium Section, Ministry of Munitions.

A. D. Constable, Esq., Superintending Electrical Engineers' Department, Admiralty.

W. J. Glenny, Esq., Chief Staff Officer, Commercial Intelligence Department, Board of Trade.

E. Gomersall, Esq., Superintending Engineer, G.P.O.

J. A. Harker, Esq., D.Sc., F.R.S., Munitions Inventions Department.

W. E. Ireland, Esq., late Chief Engineer, Metropolitan Munitions Committee.

P. Matthey, Esq., managing director, Johnson, Matthey & Co., Ltd.

J. McCaffery, Esq., Superintending Electrical Engineer's Dept., Admiralty.

W. McClelland, Esq., Electrical Engineering Assistant to Director of Dockyards and Repairs, Admiralty.

R. McLaren, Esq., of Messrs. Babcock & Wilcox, Ltd.

A. Moir, Esq., Metropolitan Superintending Engineer, G.P.O.

L. Newitt, Esq., Electrical Engineer, H.M. Dockyard, Chatham.

E. Robinson, Esq., manager, Vickers, Ltd., Sheffield.

F. E. Smith, Esq., Superintendent, Electrical Department, National Physical Laboratory.

J. Taylor, Esq., manager, Mather & Platt, Ltd.

H. Walker, Esq., Clark, Chapman & Co., Ltd.

A. A. Carnegie, Esq., Commander of Cable Steamer *Patrick Stewart*.

The list also contains a lengthy section of Members (M.B.E.).

Roll of Honour.—The Grimsby Town Council has congratulated Lieut.-Col. VIGNOLES, the borough electrical engineer, on his recent promotion, and Sergeant NUTTALL, an employé of the electric lighting station, upon winning the D.C.M.

Gunner C. NELSON, R.F.A., who has died from wounds, enlisted when 18 years of age, and when employed as an electrician at Blackpool Tower.

Private H. V. ATKINSON, Lancashire Fusiliers, formerly an employé at Burnley tram shed, was killed in action on December 25th, the day before he should have had the ribbon of the Military Medal pinned on his breast.

Private J. MACINTOSH, of the Border Regiment, who has been killed in action, was an apprentice with the British Westinghouse Co., Ltd., Trafford Park.

Captain F. B. F. HARGREAVES, South Lancashire Regiment, recently reported missing, is a prisoner of war in Germany, and suffering from slight wounds. He was the chief accountant to the Blackpool & Fleetwood Tramroad Co., Ltd.

Private L. HOLLAND, Grenadier Guards, who has fallen in action, enlisted whilst with Messrs. Bullers, Ltd., electrical china manufacturers, of Hanley.

Cable Operator S. A. BREMNER, of the Eastern Telegraph Co., Ltd., has died from consumption contracted whilst on service.

Captain P. H. DI MARCO, A.M.I.E.E., R.E., formerly general manager of the Barnsley & District Electric Traction Co., has relinquished his commission on account of wounds and ill-health, and is granted the honorary rank of Captain. On leaving Barnsley, he joined the headquarters staff of the British Electrical Federation of London.

Private L. J. CARTER, Essex Regiment, formerly with the Marconi Wireless Telegraph Co., Ltd., has, on account of wounds, had his right leg amputated. He is in hospital at Port Said.

Sergeant A. W. HUGHES, R.E., who enlisted from the Rugby workers of the B.T.H. Co., has been mentioned in dispatches by Sir Douglas Haig, and has been given a card of recognition from the General Commanding the Division for distinguished conduct in the field.

Private J. H. BROOKS, South Lancashire Regiment, formerly on the staff at the electric sub-station on the Holcombe Branch Railway, Ramsbottom, has died in hospital at Oswestry from pneumonia.

Private T. GIBSON, late of the telegraph department of the Glasgow & South-Western Railway Co., has fallen in action in France.

Captain (Temp. Major) HARRY RICHARDSON, R.E., Dundee, has been awarded the Military Cross. The Major is the general manager and engineer of the Dundee Corporation electricity department, and has been at the Front for two and a half years. He has been previously mentioned in dispatches for distinguished service at the Front.

Sapper R. F. UNSWORTH, R.E., who has died in Salonika, from dysentery, aged 19 years, was employed at the works of the Corlett Electrical Engineering Co., Ltd., Wigan.

Private R. C. CRANSTON, Lancashire Fusiliers, killed in action on Christmas Day, was formerly employed in the offices of the British Westinghouse Co., Ltd., Trafford Park.

Sergeant J. CRESSWELL, Lancashire Fusiliers, who has been killed in action, after being three times wounded, was an electrician with the Midland Railway Co.

The Military Medal has been awarded to Lance-Corporal G. PRECIOUS, West Yorks. Regiment, who was with the Bradford Corporation tramways department.

Private R. HILLS, London Regiment, formerly in the general office of the India-Rubber Co., Silvertown, has been killed in action in France. Corporal W. BROWN, R.F.A., has been severely wounded, Lance-Corporal G. PETERS, Royal Fusiliers, and Rifleman W. OVENS, K.R.R., have each been wounded a second time. All were in the proofing department at Silvertown.

NEW COMPANIES REGISTERED.

Amalgamated Tanneries, Ltd. (149,278).—Private company. Registered January 1st. Capital, £3,000 in 2,000 6 per cent. pref. shares of £1 each, and 20,000 shares of 1s. 6d. each. To take over the business carried on by the British Electric Tanning Syndicate, Ltd., at Langport, Somerset, and to carry on the business of tanners, dealers in hides and tanning materials, &c. The subscribers (each with one share) are:—S. L. Evans, The Tannery, Langport, tanner; J. Brown, Huish Episcopi, Langport, tanner. The first directors are:—S. L. Evans and J. Brown. Registered office: The Tannery, Huish, near Langport, Somerset.

Zwicky Patents Syndicate (1917), Ltd. (149,248).—Private company. Registered December 28th. Capital, £1,000 in £1 shares. To adopt an agreement with a syndicate of similar name (in liquidation) to acquire patents, to manufacture and deal in articles capable of being used in connection with electricity, heat, water, gas, ventilation, sanitation, construction, and otherwise, &c. The subscribers (each with one share) are:—W. H. Cole, 50, Brownswood Road, N. 4, solicitor's clerk; G. Kingsley, Winchester House, E.C. 2, merchant. The first directors are to be appointed by the subscribers. Solicitors: Richardson, Sowerby, Holden & Co., 5, John Street, Bedford Row, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hong-Kong Tramway Co., Ltd.—Satisfaction to the extent of £500 on June 25th, 1917, of trust deed dated July 1st, 1903, securing £195,000.

Jarrow & District Electric Traction Co., Ltd.—Satisfaction to the extent of £10,800 between October 1st, 1913, and December 12th, 1917, of debentures dated August 3rd, 1910, securing £15,000.

Nairobi Electric Power & Lighting Co., Ltd.—Satisfaction to the extent of £4,000 on December 31st, 1917, of debentures dated 1913-15, securing £20,000.

Insulated Cap & Rivet Co., Ltd.—Debenture dated December 21st, 1917, to secure £3,000 charged on the company's interest in certain premises at Junction Road, Highgate, and its general assets. Holders: Rolls-Royce, Ltd.

Bogota Telephone Co., Ltd. (69,059).—Capital, £45,000 in 20,000 pref. and 25,000 def. shares of £1 each. Return dated November 29th, 1917. 20,000 pref. and 18,607 def. shares taken up; £29,607 paid on 11,000 pref. and 18,607 def.; £9,000 considered as paid on 9,000 pref. Mortgages and charges: Nil.

Cambridge Scientific Instrument Co., Ltd.—Charge on the company's undertaking and assets (subject to £12,000 debentures authorised), dated December 17th, 1917, to secure all sums owing to H. Darwin in respect of his guarantee of the company's banking account for an amount not exceeding £10,000.

City of Oxford Electric Tramways, Ltd.—Satisfaction to the extent of £1,100 between February 22nd and December 13th, 1917, of charge dated February 20th, 1914, securing £46,000.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £4,300 on December 14th, 1917, of charges dated 1911-15, securing £250,000.

Bogota Telephone Co., Ltd. (69,059).—Capital, £45,000 in 20,000 pref. and 25,000 def. shares of £1 each. Return dated November 29th, 1917. 20,000 pref. and 18,607 def. shares taken up. £29,607 paid on 11,000 pref. and 18,607 def.; £9,000 considered as paid on the remaining pref. Mortgages and charges: Nil.

Brecknell, Munro & Rogers, Ltd.—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated November 19th, 1917. 1,058 pref. and 14,829 ord. shares taken up. £5,673 10s. paid on 1,058 pref. and 767 ord.; £7,031 considered as paid on the remaining ord. Mortgages and charges: £7,900.

Christy Bros. & Co., Ltd. (90,039).—Capital, £12,000 in 9,000 ord. and 3,000 def. shares of £1 each. Return dated August 31st, 1917. 7,926 ord. and 3,000 def. shares taken up. £1,826 paid; £9,100 considered as paid. Mortgages and charges: £4,600.

CITY NOTES.

German Companies.

The A.G. für Elektrizitäts Anlagen, of Berlin, which has a share capital of £500,000, and loans amounting to £294,000, reports a decline in the gross profits on the company's investments in supply undertakings for the year 1916-17, and an increase in the working expenses. As net profits, the accounts exhibit the sum of £31,000, as compared with £42,000 in 1915-16, and the directors recommend a distribution of 6 per cent., this contrasting with 8 per cent. in 1915-16, and in each of the four preceding years.

The accounts of *Siemens & Halske A.G.* for the year ended on July 31st, 1917, after allocating £75,000 to the Siemenstadt War Care Foundation, as in the previous year, show net profits of £643,000, as compared with £625,000 in 1915-16. It is proposed again to pay a dividend of 12 per cent., to transfer £100,000 to the special reserve fund, as in the preceding year, grant £60,000 as bonus to staff and workmen, and place £25,000 to the disposition fund, leaving £64,000 to be carried forward, as against £60,000 in 1915-16.

The report of the *Elektrische Licht und Kraftanlagen A.G., of Berlin*, which is an investment company, refers to the year 1916-17, and gives particulars concerning the position of various Russian undertakings, as well as that of the concerns in Germany in which the company holds interests. The accounts show net profits of £91,000 on an ordinary share capital of £1,500,000, and loans of £1,830,000, as contrasted with £93,000 in the preceding year. It is proposed to pay a dividend of 5 per cent., being the same rate as in 1915-16 and in each of the two previous years.

The financial statement of the *Siemens-Schuckert Werke* indicates gross profits of £1,310,000 for the year ended on July 31st, 1917, as contrasted with £1,274,000 in the preceding year. After deducting general expenses and interest charges, the net profits are returned at £793,000, as against £765,000 in 1915-16. The dividend is at the rate of 10 per cent., as in the previous year; £125,000 is transferred to the reserve fund, as in 1915-16, £100,000, as against £75,000, allocated as bonus to the staff and workmen, and £25,000 put to the disposition fund, as in the previous year. The War Care Foundation receives £75,000, and £18,000 is carried forward, these contrasting with £75,000 and £15,000 respectively in the preceding twelve months.

The accounts of *Siemens Elektrische Betriebe A.G., of Berlin*, exhibit net profits of £83,000 for 1916-17, as compared with £83,000 in the preceding year. The directors recommend the payment of 5 per cent., as in 1915-16.

The Bergmann Elektrizitäts Unternehmungen A.G., of Berlin—the financial undertaking of the Bergmann Co.—states that the construction of the Magdeburg-Schonebeck suburban line had to be suspended owing to the war. The recovery of a portion of the outstanding debts caused the deficit to be reduced from £21,000 to £14,000 on a paid-up capital of £300,000.

The Rhein Schuckert Gesellschaft, of Mannheim, reports net profits of £46,000 for 1916-17, as contrasted with £45,000 in the previous year. A dividend of 5 per cent. is in contemplation, being the same as in 1915-16. It is now intended to change the title to that of the Rhenish Electricity Co., and to extend the scope by embarking on the construction of electrical and other machinery.

The Woton Werke A.G., of Leipzig, reports the allocation of £14,000 to depreciation in 1916-17, as against £5,600 in the previous year, leaving net profits of £30,000 and £16,000 in the two years respectively. A dividend at the rate of 40 per cent. has been declared on the share capital of £40,000, this comparing with 25 per cent. in 1915-16. As a result of the great demand, the company acquired machine-tool works at Plagwitz, and the share capital is being increased to £80,000 for the extension of this undertaking.

The directors of the *Berliner Elektrizitäts Werke A.G., of Berlin*, which undertaking is now purely an investment company, state in their report for 1916-17 that the A.E.G. at present owns four-fifths of the ordinary share capital of £2,205,000, and they give a list of the securities held in various supply works. The net profits are returned at £243,000, as contrasted with £226,000 in 1915-16. After the payment of 4½ per cent. on the preference capital of £1,000,000, the balance permits of the distribution of 8 per cent. on the ordinary shares, as against 7 per cent. in the preceding year.

The report of the *Bayerische Stickstoff Werke A.G., of Munich*, which deals with the year ended on May 31st, 1917, states that the operation of the company's own works and of those under its management was influenced by the difficulties associated with the war, so that the full output was not reached in every case. A number of new plants for the production of carbide and of cyanamide were erected on the company's process for foreign account. After allocating £34,000 to depreciation, as against £46,000 in 1915-16, the accounts show net profits of £77,000, as compared with £73,000, and a dividend of 14 per cent. has been declared, being the same rate as in the previous year.

The financial statement of the *Elektrizitäts A.G. vorm. Schuckert & Co., of Nuremberg*, for the year ended July 31st, 1917, has been issued, and shows gross profits of £466,000, as compared with £516,000 in the preceding year, exclusive of £80,000 and £76,000 brought forward in the two years respectively. After deducting £171,000, as against £189,000 for general expenses, interest on loans, taxes and depreciation, and coupon tax, the accounts show net profits of £375,000, as contrasted with £403,000 in 1915-16. It is proposed to pay 8 per cent. on the share capital of £3,500,000, this rate comparing with 8 per cent., 6½ per cent., and 6½ per cent. in the three preceding years respectively.

The directors of the *Telephon Fabrik A.G. vorm. J. Berliner, of Hanover*, report an increased turnover in 1916-17 and the possession of large orders for the Government. In connection with the C. Lorenz Co., the company formed in Vienna an undertaking for electrical, physical and optical apparatus, and subscribed £20,000 as one-half of the share capital. The company was still without any reliable information concerning its foreign undertakings. After writing off £39,000 for depreciation, as against £31,000 in 1915-16, the accounts indicate net profits of £99,000, as contrasted with £123,000, and a dividend of 25 per cent. is proposed, as in the previous year. It is intended to increase the share capital by £125,000 to £375,000.

Dublin United Tramways (1896), Ltd.—5 per cent. per annum (5s. per share) on ordinary shares for half-year; £7,000 to reserve and renewal fund; £15,000 for renewal of rails; £11,500 written off investments; £13,461 carried forward.

Direct United States Cable Co., Ltd.—Interim dividend of 2s. per share, less tax at 5s., being at the rate of 4 per cent per annum, for the quarter ended December 31st.

Water Softeners, Ltd.—The accounts for the year ended June 30th, 1917, after writing off £583 for depreciation, show a profit of £4,748, which reduces the debit balance to be carried forward to £13,433.—*Financial Times*.

Underfeed Stoker Co., Ltd.—Interim dividend at the rate of 5 per cent., less tax, for 1917.

Lima Light, Power & Tramways Co.—Dividend of 1½ per cent. on the shares, less income-tax.

Companies Struck Off the Register.—The following have been struck off the register, and are dissolved:—

Cleartone Antiseptic Telephone Drum, Ltd.
Electrolysers, Ltd.
Electromechan, Ltd.
Metallic Alloys, Ltd
Tyrone Power Co., Ltd.
Universal Electric Contracts, Ltd

France.—The Société Energie Electrique du Sud-Ouest, of Paris, is increasing its capital from £960,000 to £1,200,000.

Kaministiquia Power Co.—Dividend, 2 per cent. (at the rate of 8 per cent. per annum) on the common stock for the quarter to January 31st.

Crompton & Co., Ltd.—Warrants have been posted for a dividend on the preference shares at the rate of 7 per cent. per annum for the half-year ended September 30th, 1917.

STOCKS AND SHARES.

Tuesday Evening.

The strength with which Stock Exchange markets opened the New Year received further impetus from the speech of the Premier last week-end. This had a good effect all round the Stock Exchange, inducing buying in many departments, and infusing a sentiment of cheerfulness into the House as a whole. It quickened business not only amongst high-class securities, but in the industrial market as well, and a number of the best-class commercial shares stand higher on the week.

Electrical shares have not been overlooked in this connection. British Insulated rose to 3⅛, India-Rubber shares to 14¼, and in those cases where prices have not been altered the difficulty is to buy shares, rather than to sell them. The disappointing market is still that for Home Railway stocks, where the gleam of strength imparted by a little investment after New Year's Day quickly gave place to a reaction amongst prices and a falling away of business, although the list has retained part of the improvement registered when the Stock Exchange restarted work on January 2nd. Undergrounds have come to the front during the past few days, and the Income Bonds of the big company are better at 82, while the 1s. shares put on a few pence at 5s. 3d. Metropolitans are 1 up, and in this connection it may be mentioned that London United Tramways 4 per cent. Debenture stock has gained a point at 36½. Districts, however, are dull at 15½.

Investors are, of course, putting as much money as they can into the various sources of war borrowing, but there are some who have sufficient money left over to average securities which they hold at higher prices, and there is something of a famine in the gilt-edged stocks in the Home Railway market. A few hundred pounds of Metropolitan District and London Electric 4 per cent. Guaranteed, which can be obtained at 69½, affords a return of 5 per cent. on the money. London Electric 4 per cent. Preference can be bought at 63, and District 4½ per cent. Preference at 69, giving returns of 6½ and 6⅝ per cent. respectively. There is a fair amount of Central London Guaranteed 4 per cent. Assented Preferred available at 62, offering an investor £6 11s. 6d. per cent. on his money.

The list of electrical supply shares is very steady, without, however, any change having occurred worth mentioning. We have discussed with various financial authorities the prospects of the industry as they may be modified in the light of the sub-committee's report on the coal conservation scheme. The consensus of opinion leans to the idea that the proposals for saving coal and money, put forward by the sub-committee, are likely to fare in practice no better than the various schemes drawn up to the same end in past years, and that the difficulty of obtaining anything like central control and organisation is greater than the sub-committee imagine. Therefore, from the point of view of practical politics, the scheme is regarded as interesting, but little more, and the likelihood of its having any effect upon shares in existing companies is scarcely discussed as within the province of present-day possibilities.

The recently-threatened strike amongst electrical workers was without influence upon market prices, the opinion being general that composure of the differences was only a matter of time.

The report of the British Columbia Electric Railway Co., summarised here last week, afforded satisfaction to the market and those intimately connected with this company. The results in the way of dividends were much about the same as had been anticipated, and, except for a little inquiry for some of the prior-charge stocks, no particular tendency followed the issue of the report. Anglo-Argentine Trams are still weak in consequence of the postponement of the dividend on the First Preference shares, but Brazil Tractions are a better market, thanks to the stronger tone that has developed amongst bonds of the Brazilian Government and various other securities connected with Brazil. The feeling towards Mexico also is rather more hopeful, and those who were deploring the fate of the utility companies as being sealed until the end of the war are beginning to ask whether there may not be something to "go for" before peace is signed. Of course, with prices so low as they are now, there are not many sellers, so that any little inquiry for stock exercises a sharply favourable effect upon prices. Mexico Tramways bonds of both classes are 5 points higher.

Astonishment is the prevailing sentiment in regard to the remarkable proposal placed before holders of Brisbane Electric Tramways shares by the authorities in Queensland. As things stand at present, the company can be taken over on a profits basis, but the calm suggestion is made that the company should reduce its fares (and therefore its profits) without alteration in the basis of its being taken over. Naturally the board have entered a strong protest against the injustice of such a plan, and we can hardly suppose that it will be ineffective. The incident is unfortunate, to say the least of it, and the price of the ordinary shares has fallen 10s. to 6½. Calcutta ordinary are better at 7, and the 5 per cent. debenture stock of the Electrical Supply of Victoria is 2 points up at 92.

Telegraph issues are quietly good, and Chile Telephones strengthened to 7¼. Marconis recovered to 3 3/16, Americans to 25s. 9d. The armament group is harder. Rubber shares have shaken off most of their December dulness, and the copper market is also stronger. Chemical shares show an easy tendency, with Castner-Kellners 3/32 lower at 3 5/16. At the same price, Babcock & Wilcox are 1/16 to the good.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	1916.	Price Jan. 8, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	6	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	8⅜	—	6 18 4
Chelsea	4	8	2¾	—	5 9 1
City of London	8	8	18½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	7	6	6⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¼xd	—	6 13 4
St. James' and Pall Mall ..	5	5	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅜	—	5 9 8

Telegraphs and Telephones.

	Dividend 1915.	1916.	Price Jan. 8, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	95½	—	6 5 6
do. Def.	3 1/6	1½	23⅜	—	6 8 4
Chile Telephone	8	8	7¼	+ 1/16	6 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15	—	*5 6 8
Eastern Tel. Ord.	8	8	150½	—	*5 8 4
Globe Tel. and T. Ord.	7	7	13¾	—	*5 1 10
do. Pref. ..	6	6	10⅛	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	52½	—	6 8 10
Marconi	10	15	3 3/16	+ 1/16	4 14 1
Oriental Telephone Ord. ..	10	10	3	—	3 6 8
United R. Plate Tel.	8	8	6 13/16	—	*5 17 6
West India and Pan.	6d.	6d.	1 7/16	—	*3 9 6
Western Telegraph	7	8	15¼	—	*5 5 0

Home Rails.

	Dividend 1915.	1916.	Price Jan. 8, 1918.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	60½	—	6 12 3
Metropolitan	1	1	23¼	+ 1	4 6 6
do. District	Nil	Nil	15½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	—	Nil
do. do. "A" ..	Nil	Nil	5/3	+3d.	Nil
do. do. Income	6	4	82	+1	*4 17 7

Foreign Trams, &c.

	Dividend 1915.	1916			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	5½	2½	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	65½	−1	7 11 3
Brazil Tractions	4	4	46	−1	—
Bombay Electric Pref.	6	6	9⅝	—	6 4
British Columbia Elec. Rly. Pfce.	5	5	42½	—	11 15 4
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	56	—	7 11
Mexico Trams 5 per cent. Bonds	Nil	Nil	32½	+5	Nil
do. 6 per cent. Bonds	Nil	Nil	34½	+5	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	32½	—	—

Manufacturing Companies.

	Dividend 1915.	1916.	Price Jan. 8, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3 5/16	+ 1/16	4 11 0
British Aluminium Ord. ..	7	10	1 13/32	—	6 5 9
British Insulated Ord.	17½	20	3⅛	+ ⅛	6 8 2
British Westinghouse Pref. ..	7½	7½	2 11/16	—	5 11 4
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 5/16	− 3/32	6 1 3
Edison Swan, fully paid ..	—	—	2⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅛	—	6 13 4
Gen. Elec. Pref.	6	6	10¼	—	5 17 3
do. Ord.	10	10	19¾	—	5 1 3
Henley	25	25	16½	—	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14½	+ ¼	*6 8 0
Telegraph Con.	20	20	41½	—	*5 15 7

* Dividends paid free of income-tax.

NATIONAL ELECTRICITY SUPPLY.

Interim Report of the Coal Conservation Sub-Committee.

(*Concluded from page* 8.)

While it might be feasible for local concerns, whether municipal or company, to retain, as seperate bodies, the ownership of mains and the business of supplying lighting and small power consumers, the generation and main transmission and distribution of electrical energy, and the business of supplying power to manufacturers, railways, and other large users, must, in each industrial district, be in the hands of one organisation. If the lighting and small power business were left in the hands of the existing authorities, arrangements would have to be made by the Commissioners, in settling the terms between the new authorities and the existing authorities to ensure the consumer getting the benefit of any reduction in the price of electricity consequent on generation on a large scale. There can be no question, however, that if the criterion upon which this matter has to be settled is the price of electricity and the conservation of coal, the arguments in favour of handing over the whole business to the new authorities predominate.

The proposal to link up adjacent power stations is a step in the direction of greater economy, and should be encouraged, provided it is appreciated that it is only a step. As a permanent solution it is not effective, for first, it is impossible to run a large number of linked-up stations at the highest economy unless they are under the same ownership and control, and, secondly—and more important—where such stations are under separate control a linking-up scheme, pure and simple, tends rather to perpetuate the uneconomical station than the reverse.

It has been frequently proposed as an alternative to mere linking up that bodies should be created which would deal solely with bulk supply, existing authorities being compelled to take all further electrical energy beyond what they can generate in their present stations from the new bulk supply system, and being allowed to run their existing stations as far as they desire to do so far a period of years. The disadvantages are that it would take much longer to make a change over to economical generation on account of the tendency of the existing bodies to wish to keep their own plants. The delay in the transfer of the load would prevent the greatest economies being effected. When the transfer was complete, the existing bodies would be left with indifferent plants which had become obsolete.

If the existing stations were owned or operated by different bodies they would not be of so much use for stand-by and peak-load purposes as they might otherwise be.

On the other hand, wherever there is unity of ownership and control, not only are all the advantages of linking-up secured, but the erection on correct lines of all further generating plant required is assured.

If a comprehensive system of electricity supply were inaugurated it may be confidently stated that, on the basis of the extent to which power is used at present, a saving of 55 million tons of coal per annum can be expected. Taking the value of this coal for export purposes as 10s. per ton, the national annual advantage of the change, available for interest on capital, is, say, £27,500,000 in coal alone. Alternatively, if this 55 million tons of coal were used for extended and new industrial processes, some 15,000,000 H.P. continuously throughout the year would be available for the purpose.

This saving of £27,500,000 per annum takes no account of the following additional and important advantages which would directly result from the establishment of an efficient electric power supply system throughout the country:—

1. A reduction in the cost of transport in carrying coal.
2. A possible saving in coal consumption for domestic purposes (the consumption for which purpose is now probably 35 million tons per annum).
3. The reduction in the cost of coal handling involved in house-to-house delivery and general coal distribution.
4. The great advantages and economies which would result from the more extended use of electricity in the household for heating, cooking, and cleaning purposes in the way of labour-saving devices, reduction of smoke, increased cleanliness, &c.
5. The possibility of utilising the coal at present left in the pits or otherwise wasted.
6. The possibility of extracting by-products, &c., before consuming the coal for power purposes.
7. The increase in railway electrification, with its attendant advantages, which a comprehensive electric power supply system would render commercially possible and profitable.

All these savings and advantages taken together show a total possible national advantage which can hardly be put at less than £100,000,000 per anum, apart from the manufacturing and industrial advantages of a cheap and efficient electric power supply.

It may be asked why it is that the so-called power companies have not had a greater effect in developing power supply on correct lines.

The more one considers the matter and examines the facts the more clear does it become that the so-called "Power Act" legislation was faulty in certain important respects. In the result the electric lighting authorities in the majority of important districts have, from their point of view, succeeded in practically stopping the growth of the power companies, except in one or two cases. Not only has the price of electricity throughout the country been maintained at altogether too high a figure as a result of the perpetuation of an inefficient system, but the large and ample power supply has not been made available, to the great disadvantage of the nation at the present crisis and for future industrial development.

In order to secure, even on existing lines of development, the more correct extension of electricity undertakings as the demand grows, it has been proposed to appoint electricity commissioners. Recommendations have been made by the Power Companies' Association to Sir Charles Parsons's Committee on this matter, and it is understood that their report will deal with it.

What is required is not only the appointment of commissioners, but the instruction to them to arrange in each district for the establishment of one electricity body owning and operating the electricity supply system, this body, except possibly for dealing with lighting and small power consumers, to take over all existing stations and mains, running the whole electric power supply system for the district, and at once making arrangements for the generation of power on a large scale, preferably from super-stations, erected also for dealing with the new processes already referred to.

This raises the question as to whether in arranging for such new body to take over the electricity supply business in any given area the business should be dealt with by the State, by municipal enterprise, by private enterprise, or by a combination of these. As it may be useful to consider the different alternatives possible, brief reference to them is made in an Appendix.

An analysis of the existing situation in the industrial areas of the country indicates that there are very different conditions in the different areas as regards municipal ownership. In some of the areas the important plants are almost entirely owned municipally, and in one or two areas the power companies already are commencing to own the whole business. It would, therefore, appear that one solution is not necessarily applicable to every area, and there might be advantages from a national point of view in allowing development in some districts on one line and some on another.

What is essential is that the national policy should be changed.

The aim in the future must be to concentrate under one authority for each industrial district, firstly, the main distribution system—that is to say, what may be called the main trunk electric roads—and, secondly, the responsibility for the location of the generating machinery in the most economical positions.

Recommendations.

1. It is essential that the present inefficient system of over 600 districts should be superseded by a comprehensive system in which Great Britain is divided into some 16 districts, in each of which there should be one authority dealing with all the generation and *main* distribution.

2. Centres, or sites, suitable for electric generating purposes should at once be chosen on important waterways as the future main centres of supply for each of the districts into which the country is to be divided.

3. The sites so chosen should be as large as possible, having in view the land available in suitable localities, and should have ample water and transport facilities. Land is required not only for the power stations themselves—which for the sake of security and safety would have to be suitably subdivided, that is, they would not be contained all in one building—but for the processes involved in the extraction of by-products from the coal before it is used for the production of power, where such extraction is found to be justified. It is also required for the development of electro-chemical processes, which may be most conveniently carried on in close proximity to the power plant. This condition entails the sites being chosen outside, not inside towns. (The health of the great industrial centres and the congestion of the railway lines in their neighbourhood would be radically improved by arranging that the conversion of coal into motive power was carried out away from the densely populated centres.)

4. Plans should be prepared for the construction immediately after the war on these sites of the first instalment of large super-power plants capable, first, of supplying, through a comprehensive electric power distribution system which must also be arranged for, the existing demands of the community; and, secondly, of supplying electrical energy at the lowest possible price for new processes and manufactures.

5. Such plants would be designed so that, as methods are perfected for extracting by-products from the fuel, before using it for the purpose of the production of electric power, the by-product plant can be combined with the power plant. Each site should be laid out with this in view, and with a view to the unrestricted extensions of the plant as required.

6. Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. As regards waste coal—*i.e.*, coal which it does not at present pay to bring to the surface—this could, where transport was the ruling consideration, also be used on the spot,

7. Once these plants are in existence it would be possible for existing authorities, without any risk of being left in the lurch, to stop extensions of their own uneconomical stations, situated as they mostly are on cramped and unsuitable sites, and to arrange to take their power from the main system.

8. With a view to carrying out the policy advocated a Board of Electricity Commissioners should be appointed, with full powers to deal with the electricity supply situation throughout the country. They should have power, *inter alia*,

(*a*) To stop the extension or multiplication of uneconomical stations for public supply.

(*b*) To arrange for the handing over, on equitable terms, of the generation, transmission and main distribution system in each of the areas into which the country is to be divided, to a new electricity body appointed for that area.

(*c*) To standardise for each area the frequency and voltage of the main transmission and distribution system.

(*d*) To settle for each area whether such body should consist of a Parliamentary company working under adequate control as regards limitation of dividends, &c., or one of the other alternatives given in the Appendix.

9. Alternative types of the new electric power organisations are described in the Appendix. In reference to these alternative types the Sub-Committee are impressed with the special need for initiative and resource in the management of the business of power supply, and they are of opinion that the freedom of range and keenness which are distinctive of private enterprise will be found to be in a high degree conducive to the fullest measure of success. The Sub-Committee consider that if the nation is to get immediately an efficient power supply, and is to take advantage of the temporary lull in manufacturing output immediately after the war, State assistance in some form may be necessary.

APPENDIX.

Alternative Types of Electric Power Organisations.

In considering the composition of the proposed new bodies to deal with the supply of electricity in each of the areas into which the country should be divided a number of alternatives present themselves, namely:—

(*a*) A combination of all companies and local authorities in each industrial district (as defined by the Commissioners).

(*b*) Where there is already a power company (statutory) in the area, all the other electricity undertakings, both company and municipal, to be taken over by the power company on terms arranged by the Commissioners.

(*c*) Where at present the supply is dealt with by a number of comparatively small undertakings, both company and municipal, but where the company undertakings predominate, a new company to be formed, possibly by an amalgamation of existing companies, to which the whole of the undertakings in the area would be transferred.

(*d*) Where the supply is dealt with as in (*c*) but the company concerns do not predominate, and where local feeling is strongly against a purely company scheme, a local board to be formed, representing both company and municipal interests, and under the control of the Commissioners, which would be invested with full powers to take over and carry on the whole of the undertakings, both municipal and company, in the area.

(*e*) Public or joint ownership as in (*d*) with company operation.

It is taken for granted that under any of these alternatives the Electricity Commissioners would have power to fix maximum prices and a sliding scale of prices and dividends, and to control the terms upon which capital should be raised, &c.

(*a*) *Combination of all Existing Undertakings.*—Although every one of the undertakings in the area, whether company or municipal, might admit that only by combination and concentration can economy be obtained, the attempts which have been made in the past to bring about a combination of existing concerns have shown that the interests are so conflicting that they cannot be reconciled by the interested parties acting alone. It is true that agreements for exchange of electricity have been made, but all attempts to bring about central control have failed.

(*b*) *Power Company to take over all Undertakings.*—A power company having been formed for the purpose, and equipped with the necessary statutory powers, appears at first sight to be the right body to entrust with the business of supplying the whole of the industrial district in which its own area of supply is situated; and where the power company is already established on a sound commercial and technical basis, and has shown by its development in the past that it understands its business, this method is probably the best (see the report of Lord Cross's Committee).

The statutory powers of power companies carry with them such obligations as have been found to be ample to protect the interests of the community, but if further safeguards, in addition to the control by the Electricity Commissioners, were desired, they could be imposed by Parliament.

(*c*) *New Company.*—Where no power company exists, or where the power company has not developed any very large business, a new company might be formed to take over all the existing undertakings. Local private enterprise might be encouraged to assist in the formation of the new company, with the guidance of the Electricity Commissioners, who should also settle the terms upon which the new concern would take over and carry on the business, and the statutory powers required, which would be embodied in a special Act on the lines of the present Power Acts.

(*d*) *Local Electricity Board.*—In an area where municipal enterprise predominated, the establishment of a company to take over everything, both municipal and company, might create local feeling which would be detrimental to the business. On the other hand, a purely municipal concern would be equally impracticable, since the claims of county councils, city corporations, and urban and rural district councils could scarcely be reconciled. A local board appointed by the State, subject to the control of the Electricity Commissioners, appears to be the only alternative available if private enterprise is to be ruled out. The objection to such a method is, of course, the usual objection to all purely State undertakings, namely, that they are without incentive for the proper pushing of the business, which in the case of power supply requires enterprise and resource if the best results are to be obtained, not only for the power supply business, but for the consumer and for the nation.

(*e*) *Public or Joint Ownership with Company Operation.**—By this method economy in capital and interest charges is secured, whilst the commercial development of the business on proper lines is secured by the incentive of bigger profits which the operating company would have, subject, of course, to the safeguards against high prices in the form of a sliding scale of dividend and prices—auction clauses, &c.

WEST OF SCOTLAND LINKING-UP.

The report of the West of Scotland Committee for the interconnection of electric supply undertakings, to which we made a brief reference last week, divides the local authorities and companies within the specified area into the following groups:

Group A.—Paisley, Greenock, and Kilmarnock Corporations, and Kilmarnock Electric Co.

Group B.—Glasgow Corporation Electricity and Tramways Departments and the Clyde Valley Electric Power Co.

Group C.—Alloa, Falkirk, and Stirling Corporations; the National Electric Construction Co., Bo'ness; and the Scottish Central Electric Power Co., near Falkirk.

Group D.—Lanarkshire Tramways, Motherwell and Hamilton Corporations, and Lanarkshire County Council, Cambuslang. Within this area there are also a number of private plants, a supply in substitution for which would be the business of the public supply undertakings concerned.

In regard to Group A, interconnection would necessitate a link of 3,750 K.V.A., for Greenock-Paisley, and a further 1,875 K.V.A. link to Kilmarnock, at a cost of £75,000, with a resultant economy of £5,900 per annum; with Kilmarnock omitted the cost becomes £47,300, and the estimated saving £5,200. The Committee considers that linking-up between these centres is not a commercial proposition at the present time.

Group B.—Approximate units generated, 281,000,000; coals used, 376,337 tons; coal costs, £299,115; average used per unit, 3.0 lb.; per ton, 15s. 11d. The three undertakings in this group furnish supplies at a periodicity of 25 cycles. Two of these are already linked up to some extent, and the committee has been informed by the managers that it is only necessary to install from 4,000 to 6,000 KW. of static transformers at the Dalmarnock station of the Glasgow Corporation to provide a link of maximum utility at a cost of about £16,000. Assuming that full advantage is taken of the interconnection between the three, and allowing a small average increase in economy of 0.1 lb. of coal per unit generated, the annual saving would approximate £10,000.

Group C.—Approximate units generated, 17,070,000; coal used, 32,845 tons; coal costs, £22,503; average used per unit, 4.3 lb.; per ton, 13s. 8d. The undertakings here all generate direct current, with the exception of the Scottish Central, whose system is three-phase, 50 cycles, and a portion of Falkirk Corporation supply, which is similar.

It is generally agreed that linking-up would have to be *viâ* the Scottish Central Co.'s mains. The combined week-end load of the group does not exceed 2,000 KW., and could be comfortably carried by the Scottish Central; an expenditure of £16,000 would be involved, and a saving of about £1,000 per annum made.

Group D.—The undertakings generate 8,985,000 units; coal used, 21,754 tons; coal cost, £13,031; average coal per unit, 5.4 lb.; price per ton, 12s. The undertakings all generate direct current, and have similar load characteristics; linking-up is not justified, but future requirements should be met by H.T. bulk supply.

In addition, the question of linking-up between groups has also been considered, and the following conclusions arrived at:

---

* Co-operation between municipal and private enterprise in the electricity supply business has had some success in Germany.—*See* Consular Report No. 685 on the Supply of Electricity in Germany—Cd. 7,049. A scheme embodying this principle has actually been worked out in some detail by the L.C.C. for dealing with London. Its progress was stopped by the outbreak of war, but the reports and papers relating to it are of considerable interest.

Group E (A and B).—The only practical manner in which these groups might be linked up would be by means of a link between Clyde Valley (25 periods) and Paisley (50 periods). Calculating on a link of 1,000-kw. capacity, the total cost of mains, rotary machinery, &c., was found to be approximately £12,870, while the annual saving to be expected from the interchange of energy would not exceed £1,040.

Group F (B and D).—The undertakings in Group D are all within the Clyde Valley area, and the Lanarkshire tramways are already supplied from the Clyde Valley Co. at several points. Linking up these groups would involve the extension of the Clyde Valley Co.'s mains to each of the undertakings in Group D, and the provision of rotary machinery and switchgear would cost approximately £15,000. Assuming a supply to be given at week-ends, the fuel saving would be equivalent to £1,200 per annum. There would be other advantages, but the Committee considers that linking up for the single purpose of week-end supply to the stations in Group D from the Clyde Valley Co. cannot in the meantime be recommended.

Group G (B and C).—The linking up in these two groups resolves itself into a question of interconnecting the Clyde Valley system (25 cycles) with the Scottish Central (50 cycles). Having regard to the distance between the systems, and more particularly to the difference in periodicity, necessitating rotary machinery at a new station and special staff, linking up is not recommended. The Scottish Central system, however, is of the same periodicity as the Fife Power Co., whose area of supply is included in the East of Scotland area in the map issued by the National Electric Power Supply Joint Committee, and it is therefore suggested that the district served by these two undertakings would be better considered as a separate area, making three areas in the Scottish section.

Thus, omitting the capital and saving involved in Group B, the total capital involved in linking-up would be £118,870, and the estimated saving £9,140 per annum.

Much greater fuel economy would be realised by linking-up where conditions were favourable for the purpose of a supply in bulk from the larger to the smaller undertakings, and the Committee recommends that this aspect be further investigated.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS.

The following statements, showing the imports (not for transhipment) of electrical and other materials into the various Straits Settlements ports in 1916, are taken from the recently issued official trade statistics. In compiling these statistics the first port of shipment is generally accepted as denoting the country of production. The values for 1915 are added for purposes of comparison, with notes of any increases or decreases.

IMPORTS INTO SINGAPORE.

	1915. Dollars.	1916. Dollars.	Inc. or dec. Dollars.
Telegraph and telephone materials.—			
From United Kingdom ...	389,000	692,000	+ 303,000
,, United States ...	—	18,000	+ 18,000
,, Sweden	—	22,000	+ 22,000
,, Other countries ...	16,000*	14,000	− 2,000
Total	405,000	746,000	+ 341,000
* Australia $2,000.			
Tramway and railway materials.—			
From United States ...	165,000	88,000	− 77,000
,, United Kingdom ...	77,000	95,000	+ 18,000
,, Other countries ...	13,000	3,000	10,000
Total	255,000	186,000	− 69,000
Electrical machinery.—			
From United Kingdom ...	219,000	232,000	+ 13,000
,, Germany	2,000	—	2,000
,, Italy	5,000	13,000	+ 8,000
,, Netherlands ...	17,000	5,000	12,000
,, United States ...	13,000	16,000	+ 3,000
,, Japan	8,000	15,000	+ 7,000
,, Other countries ...	23,000	30,000	+ 7,000
Total	287,000	311,000	+ 24,000
Engines, boilers, and parts.—			
From United Kingdom ...	266,000	339,000	+ 73,000
,, Sweden	—	100,000	+ 100,000
,, United States ...	8,000	51,000	+ 43,000
,, Other countries ..	27,000*	38,000	+ 11,000
Total	301,000	528,000	+ 227,000
* Denmark $5,000.			
Lamps and lampware.—			
From Netherlands ..	18,000	17,000	1,000
,, Germany	17,000	—	− 17,000
,, United Kingdom .	45,000	73,000	+ 28,000
,, United States ...	6,000	9,000	+ 3,000
,, Japan	15,000	64,000	+ 49,000
,, Other countries	15,000	28,000*	+ 13,000
Total .	116,000	191,000	+ 75,000
* Sweden $8,000.			
Machinery, other (except sewing machines).—			
From United Kingdom	502,000	699,000	+ 197,000
,, Australia	36,000	25,000	11,000
,, United States	65,000	288,000	+ 223,000
,, Other countries	116,000	170,000*	+ 54,000
Total . ..	719,000	1,182,000	+ 463,000
* Japan $22,000.			

IMPORTS INTO PENANG.

	1915. Dollars.	1916. Dollars.	Inc. or dec. Dollars.
Electrical machinery.—			
From United Kingdom	44,000	55,000	+ 11,000
,, United States ..	—	4,000	+ 4,000
,, Denmark .	2,000	5,000	+ 3,000
,, Other countries .	6,000	4,000	− 2,000
Total	52,000	68,000	+ 16,000
Engines, boilers, and parts.—			
From United Kingdom ..	163,000	247,000	+ 84,000
,, Australia	33,000	3,000	− 30,000
,, United States .	—	165,000	+ 165,000
,, Netherlands ..	5,000	5,000	—
,, Other countries .	4,000	15,000	+ 11,000
Total	205,000	435,000	+ 230,000
Machinery, other (except sewing machines).—			
From United Kingdom ..	88,000	90,000	+ 2,000
,, United States .	18,000	14,000	− 4,000
,, Other countries .	8,000	42,000*	+ 34,000
Total .. .	114,000	146,000	+ 32,000
* Malay States $33,000.			
Lamps and lampware —			
From Japan	5,000	24,000	+ 19,000
,, United Kingdom ..	28,000	54,000	+ 26,000
,, Other countries .	8,000	8,000	—
Total	41,000	86,000	+ 45,000
Telegraph and telephone materials.—			
From United Kingdom ...	—	6,000	+ 6,000
Tramway and railway materials.—			
From United Kingdom ...	2,000	9,000	+ 7,000
,, United States ...	—	2,000	+ 2,000
,, Holland . .	1,000	—	− 1,000
Total	3,000	11,000	+ 8,000

IMPORTS INTO MALACCA.

	1915. Dollars.	1916. Dollars.	Inc. or dec. Dollars.
Telegraph and telephone materials.—			
From United Kingdom ...	2,000	3,000	+ 1,000
Engines, boilers, and parts.—			
From United Kingdom ...	5,000	4,000*	− 1,000
* Entered through Malay States.			
Electrical machinery.—			
From United Kingdom ...	1,000	—	− 1,000
Machinery, other (except sewing machines).—			
From United Kingdom ...	18,000	67,000	+ 49,000
,, Other countries ..	11,000*	2,000	− 9,000
Total .. .	29,000	69,000	+ 40,000
* Federated Malay States $10,000.			

N.B.—Dollar = 2s. 4d.

Hamburg Electricity Works in Difficulties.—The following notice appeared in *Hamburger Nachrichten* on December 4th:—"Owing to breakdown (Betriebsstörung) in a power station of the Hamburg Electricitäts-Werke, it is essential that all motor loads be disconnected until further notice between the hours of 4 p.m. and 9 p.m. It is, therefore, strictly forbidden to run motors during this period. In case of infringement of this order, the offending installation will be disconnected from the lighting network." It will be interesting to learn the precise nature of the trouble which has necessitated such a stringent order.

THE RONTGEN SOCIETY.

A New Portable X-ray Tube Construction.

At the meeting of the Röntgen Society, on January 1st, Mr. Carl Darnell, representing Mr. W. D. Coolidge, of the Schenectady Laboratories, demonstrated a new radiator type of hot-cathode X-ray tube, and also a portable X-ray generating outfit to accompany it. He said that these had been developed in America specifically for use at the Front, where portability was a chief consideration. The electrical efficiency of existing portable X-ray generating outfits was low, but it could be greatly increased if a suitable tube were forthcoming for operating directly from the secondary of a high-pressure transformer without the use of any auxiliary rectifying device. The existing type of hot-cathode tube —*i.e.*, the ordinary Coolidge tube—might fulfil this condition, but it would require the use of a large focal spot, which was a disadvantage for radiographic purposes. The essential condition was that heat should be more rapidly withdrawn from the focal spot than was the case with the ordinary Coolidge tube, and the device of water-cooling whereby this might have been done would have interfered with the portability. Experiment proved that the most effective and simple method was to build a target with a large heat capacity and high heat conductivity, and then to provide that the mass of metal should be cooled at the time when the tube was to be given its full load. The anode of the new tube, therefore, consisted as to its stem of a solid bar of copper, which was brought right out through the glass of the anode arm to a copper radiator. The head of the anode consisted of a very small wrought tungsten button set in a solid block of specially purified copper, which was electrically welded on to the stem. The tungsten button designed to receive the cathode-ray bombardment was 0·1 in. in thickness and ⅜ in. in diameter. The complete target with the radiator had a heat capacity considerably greater than that of the present standard solid tungsten target, and the tube, therefore, for a given milliamperage and voltage could be operated several times as long as the other before the target was brought to red heat. But an even greater advantage was the fact that, between radiographic exposures, the target in this new tube cooled comparatively rapidly, owing to the delivery of the heat to the external radiator. And whereas the older tubes radiated a great deal of their energy through the glass of the walls, which became quite hot, in this new tube the larger part of the energy imparted to the target was conducted out to the radiator, so that it was possible to make the glass bulb very small. Actually for portable work a bulb diameter of 3¾ in. had been standardised. The passage of inverse current was avoided in this tube also by the construction which removed heat from the focal spot so rapidly that, in normal use, it never reached the temperature at which appreciable thermionic emission of electrons took place. The first model of this new tube had been designed to carry 10 ma. at a 5-in. parallel spark gap for a sufficient time to make the most difficult radiographic exposure, and, for screening purposes, to carry a load of 5 ma. at 5-in. parallel spark gap continuously for an indefinite period.

Two portable X-ray generating units, which were also demonstrated, have been built round this tube model, and are being used in the United States Army. In both of them the tube is operated directly from a high-voltage transformer, with no auxiliary rectifying device. A second paper by Mr. Coolidge and Mr. Moore described this unit in detail, and stated that after considering various types of apparatus, a gasoline-electric set was adopted, furnishing alternating current to a step-up transformer, with the self-rectifying X-ray tube operating directly from the latter. This gasoline-electric set delivered alternating current at about 45 cycles and 120 volts to the step-up transformer. The advantages of the outfit were control of line voltage, making it possible to duplicate electrical conditions and X-ray results very accurately, and the absence of moving parts other than the gasoline set itself. The new apparatus was discussed by a large number of members, one of whom compared the innovation to that of the Kodak in photography.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

19,046. "Electric lamps." T. W. Cairns. December 24th.

19,050. "Overhead trolleys or collectors for electric tramway or railway vehicles." W. Rees & C. O. Taylor. December 24th.

19,063. "Spring terminals for electric accumulators." Fuller Accumulator Co. & A. P. Welch. December 24th.

19,064. "Electric safety-lamp cases." Fuller Accumulator Co. & A. P. Welch. December 24th.

19,065. "Manufacture of carbon electrodes." C. H. Thompson. December 24th.

19,082. "Diaphragms for electrolytic cells." Chemische Fabrik Weissenstein & R. Walter. December 24th. (Austria, December 19th, 1916.)

19,090. "Rectifier for wireless telegraphy." J. F. Miller. December 27th.

19,096. "Controllers of direct-current electric motors for hoisting and lowering apparatus, &c." Electric Control, Ltd., & S. Thompson. December 27th.

19,098. "Sparking plugs for internal-combustion engines, &c." J. E. Gimbert. December 27th.

19,099. "Telephone transmitters." A. Marr. December 27th.

19,108. "Electromagnetic methods of detecting submarines." R. Beattie. December 27th.

19,110. "Electric cable junction fittings." A. M. Lovett, A. C. Manifold and F. G. Pyne. December 27th.

19,123. "Sparking plug ignition wire clip for rotary aero engines, &c." W. Oswin. December 27th.

19,126. "Electric insulators." Soc. Ceramica Richard-Ginori. December 27th.

19,131. "Means of control for searchlights, &c." W. A. Stevens. December 27th.

19,135. "Pocket electric lamp." A. P. R. [illegible]. (France, December 2nd.) December 27th.

19,140. "Telephone and microphone receivers." C. Teasdale-Buckell. December 28th.

19,159. "Self-engaging [illegible] for electric machines." R. H. Lane. December 28th.

19,170. "Electrolytic preparation of metals or alloys in the form of paste, sludge, or sponge." B. Leech, and H. & L. Slater. December 28th.

19,176. "Focusing incandescent electric lamps for optical projection purposes." F. C. Jenkins. December 28th.

19,191. "Electric switches." H. N. Davis & W. R. Twigg. December 28th.

19,195. "Safety devices for interlocking operating parts of enclosed switch, &c., gear with door or doors of enclosing casing." J. A. Hirst. December 29th.

19,239. "Interrupters or contact-breakers for magneto-electric machines." A. M. Allen & R. B. North. December 29th.

19,240. "Chain electric welding machines." British Insulated & Helsby Cables, Ltd., & P. Bucher. December 31st.

19,252. "Sparking plugs for internal-combustion engines." J. Hill. December 31st.

19,280. "Party-line ringing systems." Western Electric Co. (Western Electric Co., U.S.A.) December 31st.

19,290. "Electric systems for motor vehicles, &c." Bijur Motor Lighting Co. December 31st. (U.S.A., April 30th.)

19,304. "Sparking plugs for internal-combustion engines." L. Lavoisier. December 31st.

19,322. "Electric heating apparatus." A. J. Allen & L. V. Leonard. December 31st.

19,351. "Alternating-current electromagnet." D. C. Larson. December 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

9,055. Electric Furnace for Steel Melting. S. Steinberg & I. [illegible]. June 27th, 1916. (111,679.)

9,408. Electric Hand Lamps. J. W. Manley. July 20th, 1917. (111,680.)

15,500. Construction of Dynamo-electric Machines. Sandycroft, Ltd., R. L. Cleaver & H. E. Potts. October 31st, 1916. (111,689.)

15,803. Contact Breakers for Magnetos. Soc. Anon. Appareillage Electrique Grivolas. December 27th, 1915. (102,936.)

17,260. Portable Telephone and Signalling Apparatus. H. C. Crews. December 1st, 1916. (111,694.)

17,277. Electric Switches. H. C. Widlake. December 1st, 1916. (111,695.)

17,450. Electric Lighting Systems applicable to Vehicles. H. A. Gill (U.S. Light & Heat Corporation). December 5th, 1916. (111,704.)

17,528. Dynamo-electric Machinery. E. S. G. Rees & W. Armistead. December 6th, 1916. (111,709.)

17,626. Dynamo-electric Generators and Reversing Mechanism therefor. J. Stone & Co. and A. H. Darker. December 7th, 1916. (111,718.)

17,701. Electric Water or other Liquid Heaters. J. S. Langford. January 14th, 1916. (103,475.)

17,856. Control of Electric Motors. J. M. L. Slater. December 12th, 1916. (Cognate application, 84/17.) (111,723.)

17,996. Selection of Electric Currents. A. Perego. December 14th, 1916. (111,728.)

18,223. Device for Demonstrating to Classes or Individuals the Relation between True and Magnetic Bearings. W. J. N. Fairley. December 20th, 1916. (111,732.)

18,386. Method of Energising Aerial Conductors for Wireless Signalling and other purposes. G. Plaisant. December 22nd, 1916. (111,735.)

1917.

1,555. Electrolytic Production of Metal Wire and Strip. S. O. Cowper-Coles. January 31st, 1917. (111,757.)

2,106. Device for Testing Magnetos and Sparking Plugs. E. Morgan. February 12th, 1917. (111,760.)

2,439. Temperature Compensators for Electrical Control Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 19th, 1917. (111,764.)

2,624. Oil-break Electric Switches. R. W. Gregory & Electrical Improvements, Ltd. February 22nd, 1917. (111,766.)

3,160. Manufacture of Clay, Plumbago and other like articles by Electro-deposition on Metal Moulds. B. J. Allen. March 3rd, 1917. (Addition to 2,252/17.) (111,775.)

5,898. Means for Cleaning the Sparking Plugs of Internal-combustion Engines and the like. J. H. Andrew. April 26th, 1917. (111,794.)

6,399. Mounting and Insulating of the Contact Parts of Electric Switches. H. H. Berry. May 4th, 1917. (111,796.)

11,036. Electric Circuit Controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) July 31st, 1917. (Patent of addition not granted.) (111,812.)

11,579. Sparking Plug Tester. W. Hanman. August 11th, 1917. (111,813.)

13,098. Resistance Switches for Controlling the Intensity of Electric Currents. J. Watkinson & W. Adams. September 12th, 1917. (111,821.)

13,551. Trolley Wire Systems for use on Electric Railways, Tramways and the like. P. Dawson & F. W. Fawdry. September 20th, 1917. (111,822.)

16,756. Electric Lighting Systems applicable to Vehicles. H. A. Gill (U.S. Light & Heat Corporation). December 5th, 1916. (Divided application on 17,450/16.) (111,833.)

Russian Electrical Regulations.—In view of the project of law prepared by the Ministry of Trade and Industry on granting freedom to private contractors in the matter of installing electrical conductors and constructing installations, the chief Board of Local Economy proposes to draw up a series of rules for the purpose of protecting the interests of districts and towns from capitalistic contractors in the matter of electrical transmission.

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ECONOMIC PROBLEMS.

During the past few weeks the greater part of the world has been discussing momentous utterances by leading Statesmen who have laid down the terms on which they would be prepared to discuss Peace. These statements will be regarded as superseding others that preceded them, and they will probably form the basis upon which much discussion will take place in days to come. The average lay mind is not privileged to know what may be taking place in diplomatic circles, but from enemy Press utterances it appears unlikely that these speeches will have an immediate effect in bringing about actual negotiations, though ultimately it may be found that they have contributed to that end. One important outcome, however, and probably one of several that they were intended to produce, has been the re-establishing of a strong unity of aim and effort among our own and Allied peoples. The strain of war is unquestionably heavy—critically so—upon all the peoples of Europe, yet, notwithstanding this circumstance, the enemy cannot fail to be impressed by the new reinforcement of strength that has come to the Allies from such a spirit of unity. But the unity has to find expression in the carrying into effect of new measures which make a further call upon the man-power resources of the United Kingdom, and impose new restrictions upon industry. The conferences with Labour which made the occasion for the Premier's considered speech, have extended over the past ten days, and they still continue; it is to be hoped that what is required will be made possible with a minimum of friction, notwithstanding the present obnoxious attitude of the A.S.E. Yet we cannot fail to bear in mind that even if Labour concedes all that is hoped for from these conferences, and finds the men asked for, Industry will need to adapt itself with the greatest possible care to the conditions that will follow if we are to avoid evil effects upon the revenue-producing industries of the country. The need for a strengthening of the Forces is, of course, paramount, whether the remaining stages involve more heavy fighting, as seems at the moment inevitable, or whether months are spent in preliminary and actual negotiations. In addition to the maintenance of the fighting forces at their maximum possible strength, we have also to bring together a new army of men to accelerate our rate of shipbuilding. To build new ships with utmost speed now is to help defeat the submarine devilry of the enemy, but it is also a measure of utmost importance which will ensure that ships shall be available in great numbers for urgent mercantile purposes when the war ends. Therefore, this new demand has to be made upon Industry and Labour to find many thousands of men to accelerate the carrying out of the great shipbuilding programme.

While we are thus compelled to centre our best energies upon a continuation of the struggle with all the means at our disposal, there are certain war questions other than man-power and shipbuilding which necessarily claim very serious thought after three and a half years of terribly wasteful war. The financial burden of conducting operations on so vast a scale is becoming an ever-increasing anxiety in most of the lands that are involved in hostilities. There has been no dramatic crash anywhere such as might have been anticipated, though we are more or less in the dark as to what is actually the state of affairs in Russia. But though there has been no sensational event of that kind, there can be no question that the financial problems for all the nations in the coming days will be of such a character that the old methods of dealing with such matters will not suffice. Expert authorities are coming forward with suggestions regarding what we may have to do in order to pay the interest on our heavy load of war debt, and to reduce the debt itself.

Taxation, as we know it, seems to have practically reached the limit, though Labour has advanced some sweeping proposals in that connection. It is impossible to go on taxing capital, however invested or held, up to the hilt, without injuring industry, by which we live. Much has been said concerning "Conscription of Capital." If that means what we think it means, it is inconceivable to contemplate prosperity of industry, and therefore plenty of work for everybody, after such procedure. Those who are putting their money into War Loans do so because they have the credit of the British nation to depend upon. Industry will be imperilled, in many cases actually confiscated out of existence, if we confiscate its capital, and such a shaking will have been given to the foundations of British credit as will prevent it from recovering its equilibrium for many a year.

Where, then, is the money to come from to meet the increasing financial burden? We are constantly being advised that when we come to the great task of re-establishing our pre-war industries and our foreign trade we shall need the fullest co-operation of the forces of Capital and Labour, and the assistance, in certain ways, of the State. As a matter of fact, something more will be needed. Beyond the increased productivity that such co-operation should assure, we shall require to adopt large ideas for the increase of wealth by the enterprising utilisation of the vast resources of the Empire, and by aiding certain Allied nations to develop their own resources for their own and for world benefit. Conscription of existing wealth would not only undermine national credit, it would jeopardise industry, lessening revenue instead of permanently relieving our burdens. What seems to be one of the urgent necessities of the moment is for the recommendations of the Empire Resources Development Committee, as set forth in the report issued last year, to be carried into effect with the utmost reasonable expedition. In an address to the Royal Colonial Institute last week, Mr. H. Wilson Fox, M.P., discussed some of those recommendations. He was speaking on "The Payment of War Debt by Development of Empire Resources." He estimated that the post-war revenue that the Government would have to raise to meet its obligations could not be less than £600,000,000 per annum, and some new method of raising the money would have to be found. He opined that taxation of imports was unlikely to yield any sum that would go far to meet our needs, and expressed the view that the burden of income-tax could not be increased indefinitely, while the conscription of existing wealth would be a dangerous and impracticable expedient. New wealth, he went on to say, must be produced under conditions which would assure to the State itself the direct receipt of a substantial share of the profits earned. Such a means was to be found in the adoption of the recommendations of the Empire Resources Development Committee.

The reports that have been put before us all during the past decade concerning the potential wealth of some of the British Colonies and Dependencies have read more like fairy tales than as business documents, so vast have been the possibilities that they have unfolded before us. The time is coming when probably some of the dreams which under normal conditions seemed unlikely to emerge into actualities may assume definite form under the conditions that will in the near future confront us. It may be that, notwithstanding the availability of demobilised forces, the need for larger population will hamper the Colonies in the fuller development of their resources, as it has done in the past. It may even be that what has been happening behind the lines in France will repeat itself in the future wealth creation of the world. Barriers of race and colour may be broken down, and labour armies of all nationalities may be utilised on great development projects to help to relieve the economic burdens of all after the war.

Our own Statesmen and the President of the United States have laid it down emphatically in their recent speeches that there will be no economic war after the war, though, as a war measure, such is necessary and justifiable. Possibly there may yet be co-operation of all democratic nations in the general development of the world resources for the benefit of the people of all lands. Sir A. Steel Maitland, however, does not appear to see any immediate prospect of such co-operation. In his speech of Tuesday last he warned an audience of business men that competition after the war would be keener than we had ever known it.

The Whitley Recommendations: A Matter of Urgency.

Dr. Addison last week referred to the urgent need that exists for more speedy progress being made with the formation of Industrial Councils, as recommended in the Whitley Report. It is now getting on for a year since the conclusions of the Whitley Committee were arrived at, and we are convinced that a number of Labour troubles that have developed since then might have been prevented if there had existed suitable machinery for dealing with the causes of friction before disagreement had reached a critical stage. There seems to have been most regrettable delay somewhere in applying the principles laid down. We are not overlooking the fact that the difficulties of the times are so great that it is not as easy as it might be in normal times to establish new organisations in which varied interests are concerned. We are aware, also, that in some works, arrangements already exist which provide very well for the maintenance of good relations between employer and employed. Further still, we know that there is a very truculent element in the country which pours scorn upon the Whitley idea, and means to oppose its application tooth and nail, because it wants Labour absolutely to control industry, and therefore despises suggestions for the establishment of good relations. The difficulties of the times, however, are in some respects an argument on the side of urgency, and no stone should be left unturned to secure harmonious working for the remainder of the war, as well as after it. The satisfactory experience of some manufacturers with their own arrangements is also an argument in favour of the Whitley spirit and its wider application along properly ordered lines. The opposition of the obstructive element, while it cannot be ignored, must not be treated too seriously, because we believe that when Labour as a body properly understands the proposals, the majority of its supporters have the good sense to see that along these lines, rather than by the pursuit of ideals in the deplorable Russian fashion, order, harmony, and prosperity are to be found for millions of our toilers. Dr. Addison, as Minister of Reconstruction, occupied as he is with a hundred enterprising proposals for paving the way to prosperity in the years of Peace, appreciates the urgency of the application of the Industrial Council idea in the interests of industries. Though we are calling up nearly half a million more men, we need to be prepared for "the dislocation which would arise on the proclamation of Peace, or even the declaration of an armistice." Organised associations of employers and employed will be essential in order that the Government may be able to confer with the industries on the many problems that will be bound to arise. Dr. Addison was speaking at a meeting at Stoke-on-Trent of the first National Industrial Council so far organised; it is concerned with the pottery industry. We hope that his appeal for greater expedition will not pass unheeded, though we recognise that there is still a great deal of ignorance upon the part of the public as to what the Whitley recommendations are. There is urgent need for propaganda work—making these things better known throughout the length and breadth of the land. The scarcity of paper prevents the newspapers from printing all that they would have published under normal conditions about this and many other matters. Everybody is too busy to read much, even if it were published. War news is about all that the average newspaper reader is interested in at present. It is unfortunate for the movement that these things should be so, for, in our opinion, they are a very real handicap. The recently formed Industrial Reconstruction Council has an important popularising duty lying before it, and we have every hope that it will soon be able to do useful work assisting the more expeditious application of the Whitley recommendations as urged by Dr. Addison.

REMINISCENCES.—III.

By "EX-SHIFT DOG."

Shift work in power stations is not often fraught with exhilarating experiences, and memories are more often of exciting and sad occurrences, and of regrettable visits to "the carpet" in the Chief's office; nevertheless, more than once such frivolities as tea parties have been successfully organised upon quiet Sunday or other afternoons, and similar innocent diversions can be recalled by most shiftmen of lengthy experience. Unfortunately, the topography and neighbourhood of the majority of stations do not favour the arrival and departure of guests, and usually one must, therefore, be content with the company of one's technical associates, some of whom do not constitute ideal companions. However, taken as a class, the technical personnel of English power stations is of good social standing and of decent antecedents. Company, too, is not always confined to the *genus homo*. Rats, beetles, fleas, cats, and bull-dogs are among improbabilities which come within the scope of actual personal experience, the smaller species being the greatest nuisances. Poison for beetles may also be objectionable for human consumption, and an unsuccessful crusade of beetle extermination resulted in a six weeks' dangerous illness for the originator of the idea; fleas are equally hopeless in many riverside stations.

Facilities for the obtaining of circulating water are naturally of great weight in the selection of a site for a generating station, but the staff will never forgive the originators of the plans of a certain station which is immediately adjacent to the town's sewage farm. Regularly at 4 a.m. the engine room floor was sprinkled with carbolic powder in the endeavour to combat the effluvia resulting from cleaning operations next door—a precaution which was so far successful that it enabled one with a struggle to just support animation. This station also supplied steam through a reducing valve, giving 80 lb. per sq. in. from a 160-lb. supply, to the neighbouring air compressors and sewage pumps; the inauguration of this arrangement was the occasion of much trouble from this valve, which persisted in alternately sticking open and shut; the effect was exceedingly comic in the pump house, but also exasperating. It was several weeks before that valve consented to behave itself, in spite of all humourings and overhauls.

Seaside power stations have certain troubles to contend with which do not obtrude themselves upon inland localities. Particularly along the "front," salt water spray attacks all polished work relentlessly, and arc lighting is only possible by the aid of quantities of vaseline upon rods, &c. When this state of affairs is aggravated by bad arrangements of gear, and neglect on the part of the outside staff, things tend to become chaotic. Such were the conditions when and where the writer was apprenticed; and, as the junior station man, it was frequently his lot to assist also on outside work. A particular set of arc lamps illuminated a busy jetty, and had an unpleasant habit of refusing duty in the early winter mornings. Two a.m. once saw the writer lashed up to the top of a lattice pole endeavouring to locate the trouble in one of these lamps, in pitch darkness and heavy rain; and the language used when eventually it was discovered that the day duty arc trimmer had left one lead disconnected from its terminal almost obviated the necessity for any other illuminant. Then immediately afterwards, when operating the D.P. knife switch controlling this circuit, and with both feet in a pool of water, the handle of the switch came away, causing the operator to slip and so deposit his hand neatly across the live terminals. The arrangement of the control gear, apart from its questionable quality, was very poor, and most things were beautifully un-get-at-able. Live lamp poles were of frequent occurrence, and main circuit fuses were well down in the pole bases, quite a foot below the level of the door. Faults of all sorts were, of course, common, and arc shunt coils burnt out with regularity and frequency.

Scales of bus-bar voltmeters are usually "set up," that is to say, they do not indicate when the pressure is more than, perhaps, 10 per cent. below or above normal; and this is a practice which is most convenient and desirable.

But if the paralleling gear is not of the balance type, wherein equal bus and incoming pressures give a zero reading (and in the case of A.C.) it is also desirable to have at least one bus voltmeter with a full scale, together with similar instruments for machine pressures. A certain D.C. network is supplied by steam sets in parallel with a large, but somewhat remote rotary converter sub-station. A complete shut-down of the directly steam-generated supply threw the load of the local district on to the outlying feeders of the sub-station, so that the latter's pressure feeding back to the station was about 25 per cent. low; time was then wasted in connecting up temporary voltmeters for paralleling in again, for all the permanent instruments were set up and were showing no reading. Except for this proviso, large scale voltmeters, steam-pressure, and vacuum gauges are excellent aids to accurate and smooth operation and regulation, and in an A.C. station direct-reading KW.-meters on all machines and the more important feeders are equally desirable. Steam-flow meters on boilers, too, are beginning to be realised to be as useful and as necessary as ammeters upon D.C. generators.

Rotary converters and motor-generators are not often run together in parallel on both supply and delivery, but they operate very well under these conditions so long as neither the speed nor voltage variations of the supply are frequent or excessive. Their characteristics are, of course, rather unlike in these two particulars, and they tend to alter their load distribution rather much if one variable changes without a corresponding alteration in the other. Rotaries, as a class, require a good deal of tact in operation. A certain trio of very large converters (A.C. to D.C.) had a nasty habit of occasionally developing surging between them, and this usually ended in a flash-over unless in the incipient stages the fields were varied quickly and skilfully. To minimise the trouble the D.C. breakers were fitted with lightly set reverse relays, and it became the practice to synchronise the incoming rotary with its volts slightly low, in order to ensure that it picked up load on the D.C. side immediately. This was being done by routine on one occasion when the load was rather light on the running machine, and just as the A.C. switch was closed (and it was a trifle "late") a D.C. feeder tripped. There was a slight flash from the incoming rotary's commutator, the running one tripped on reverse (D.C.), and there was no sign on the D.C. or A.C. voltage charts of any irregularity! On another occasion one phase of a two-phase generator, supplying, amongst other demands, a large six-phase rotary converter, was accidentally opened; apart from a drop in volts, no great trouble occurred; all synchronous plant remained in step, and normal conditions were resumed without further comment when the second phase was reconnected.

Automatic boosters and regulators are frequently looked at askance by the older generation of engineers, but, on the whole, they operate well, albeit more than one "automatic" booster has been stripped and converted into a plain shunt hand-regulated machine after the patience of the station staff has been exhausted. Regulators are more satisfactory when they are designed together with the exciters upon whose fields they operate, and it sometimes pays to keep the exciter's voltage more or less constant at the regulator's best operating value, by means of hand adjustment of a rheostat in the main rotor circuit. Some old-type regulators are liable to hunt upon slight provocation, and one experimental model succeeded in giving a very good imitation of lightning effects upon the lights supplied; it was, of course, quickly cut out, and never afterwards had any opportunity given it to repeat the entertainment. It has often been stated that it is impossible to operate machines controlled by separate regulators with "astatic" characteristics, in parallel; but if the machines, or groups of machines, are situated in different stations, it is quite a satisfactory arrangement, provided always that the interconnecting lines have sufficient resistance or reactance to allow a margin of scope for the regulators, and the system is in actual daily operation.

Remote control switches are addicted to occasional vagaries in their operation, and should be systematically inspected and overhauled. In one instance an earth on some lighting supplied from the same source as the relay operating circuits caused a generator switch, having another earth on its control wiring, to trip and immediately close again; the fuse on the lighting sub-circuit then blew, and it was not until it had been renewed and the cycle repeated that the cause of the very heavy surge was realised, for the operation of the generator switch was not observed in the first instance. Similarly, a generator switch once developed a very long time-lag in closing, so that when the set was synchronised, the signal lamps lit up for "closed," but the switch was actually only slowly travelling into contact. The operator, noticing the behaviour of the synchronoscope, realised that something unusual had occurred, and immediately proceeded to draw the E.H.T. isolating links. He had drawn two by the time the switch actually arrived home, and thus had averted disaster, for the neutral was not in this case earthed. Indicating lamps should be on entirely separate circuits from the control system, and their contacts should preferably be mounted upon the rods carrying the main H.T. contacts; this is so arranged by some makers, but should be specified in all remote control contracts. Failure to operate altogether is generally due to lack of attention—*i.e.*, journals or clutches remaining dry and seizing, stiff toggle joints, and similar mechanical details; but faulty operation is even more dangerous, and is usually the result of mechanical wear, sparking at contacts, or electrical open or short circuits in the control gear; occasionally a current transformer will be found to have increased its ratio by a partial short-circuiting of the H.T. turns, but such cannot easily be detected until an actual breakdown occurs. Time-limit fuses should be religiously tested for continuity before use, and when unsatisfactory, put unmistakably on one side; considerable time and much energy were wasted in testing the parts and functions of a switch whose operation was inexplicable, until the whole trouble was eventually found in a faulty time-limit fuse which appeared to the eye to be perfect.

All switches, levers, and valves ought to be labelled, but such labelling can be carried too far; and if sketches are provided they should be diagrammatic rather than actual working drawings, and inscriptions should be bold and suitably placed. Modern switchboards tend to uniformity of appearance, panel by panel, and it is often a fatally easy matter to operate a wrong switch, particularly with remote control A.C. Standing alternators have been switched in instead of running rotaries, and similar mistakes made which might have been avoided by the use of conspicuous labels. A raw improver was once sent to shut down a roof fan, and, instead, proceeded to open the unlabelled main switch of the driving side of a motor-generator, which supplied the excitation to the largest A.C. unit in use at the time; naturally, the results were far from happy, but the whole episode might have been avoided by the use of a suitable label.

CABLE FAULT LOCALISATION IN PRACTICE.

By D. M. W. HUTCHISON, M.I.E.E., B.Sc.

There are not many methods of locating faults in underground mains which are of much use to the mains engineer, and really practical information on the subject is not easily obtainable. The writer hopes that by giving some of the actual results of his own experience in the past, he may be of some service to engineers in charge of cable work.

Several years ago the writer had charge of a cable system composed partly of three-core jute-insulated V.B. sheathed cables and partly of lead-covered paper-insulated three-core cables. Faults occurred on the system at the rate of about one a week; most of the faults occurred on the V.B. cables, which were eventually replaced by paper-insulated lead-covered cables.

A few weeks' work convinced the writer that one of two tests would serve to locate any fault that could be located with certainty; these were the loop test with a special bridge, and a fall of potential (F.P.) test.

Loop tests, with the dial resistance boxes supplied in so-called "mains testing sets," and search coil tests, were found to be very inaccurate, and were abandoned.

The bridge used consisted of 500 in. of No. 16 copper wire marked in 10-in. sections by rings of paint on the wire itself. This wire was stretched round insulators on a board; the ends were sweated to V.I.R. leads of equal length, provided with terminals suitable for attachment to link box, fuse box, or feeder pillar fittings, or to cable cores.

Current for testing was taken from the mains, and a resistance of 10 25-c.p. carbon lamps was used; the galvanometer used was that fitted in a mains testing set, but later on the millivoltmeter of a Century testing set was found to be more sensitive; a tapping key was used in the galvanometer circuit.

For the F.P. test, a 4-volt accumulator or a bank of lamps, a reversing switch, an arc-lamp resistance, and the same galvanometer as used in the loop test were all the apparatus required.

On the occurrence of a fault the procedure was as follows:—All service fuses were removed, both ends cleared, and a Megger test and lamp tests were made; the fault was then classified as follows:—

Class (1) All cores shorted and earthed.
(2) „ „ „ but not earthed.
(3) Two cores shorted, third good, no earth.
(4) „ „ „ and earthed, third good.
(5) One core earthed, others good.
(6) Total disconnection.

In Classes 3, 4, and 5 the loop test was used provided enough current could be passed through the fault to make the resistance lamps glow.

In Classes 1 and 2, and in Classes 3, 4, and 5 where the fault was of sufficiently high resistance to prevent the lamps glowing, the F.P. test was tried.

In Class 6 the method used was cut and try, attempts at localisation not being consistently successful.

It is important that the lamp tests should be made to supplement the Megger tests, as may be seen by studying the examples given below.

If a loop test was possible, the equivalent length was calculated in the usual manner, and one example will suffice to show the method used.

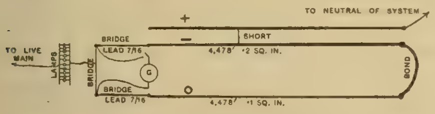

Fig. 1.

Example I.—Fig. 1 (loop test, Class 3 fault), 3-core V.B. cable.—Megger tests.

+ to E	5,000 ω	+ to 0	12,500 ω
− to E	5,000 ω	− to 0	12,500 ω
0 to E	12,500 ω	+ to −	zero ω

A lamp test showed that it was possible to light the bank of lamps through the short circuit.

Length of Loop.

Length of cable ... 4,478 ft. ·2 = 4,478 ft.
„ „ O cable ... 4,478 ft. ·1 = 8,956 ft. ·2 sq. in.
„ „ bridge leads 24 ft. $\frac{7}{16}$ = 215 ft. ·2 sq. in.

Total ... ... 13,649 ft. ·2 sq. in.

1 in. on bridge = 13,649/500 = 27·29 ft. on ·2 cable.

The test was made according to the above diagram, the wire from the lamps being moved up and down the bridge wire until the millivoltmeter showed no deflection; the bridge leads were then reversed, and another reading was taken.

The calculation is a simple one, thus: zero position was found on the average of the two readings to be 154 in. from the end of the bridge attached to the faulty cable.

Distance to fault 27·29 × 154 = 4,202 ft. 6 in., less 107 ft. 6 in. for one bridge lead ≐ 4,095 ft. of ·2 sq. in.

A check test from the other end gave a slightly different position; the mean was taken, and the fault was found 30 ft. away, an error of ·67 per cent.

With a loop test the error in most cases was well under 1 per cent.

Example II.—Fig. 2 (loop test, Class 3 fault).—This has been given, as it is a good example of how the Megger tests may be misleading if not supplemented by lamp tests.

Three-Core V.B.—Megger Tests.

+ to E, − to E, 0 to E } 500,000 ohms
+ to −, + to 0, − to 0 } zero ohms

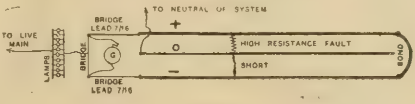

Fig. 2.

A lamp test, however, showed that it was possible to light the lamps through − to 0 only; they would not light through + to 0 or + to −. This could then be classed as a Class 3 fault, and a loop test applied.

The error in locating this particular fault was 16 ft. in a length of 451, or 3·5 per cent.; this large error was due to the negative core at the fault being almost entirely burnt away.

Faults of Classes 4 and 5, provided the lamps can be made to glow through the fault, are tested out in exactly the same manner as Class 3 faults.

In making loop tests the *sine qua non* is to have one sound (that is, comparatively sound) return; loop tests should be used in preference to F.P. tests where possible, as they are less liable to external disturbances.

In making loop tests it should be remembered that if the galvanometer cannot be made to reverse through zero by sliding the wire up the bridge from end to end, there is a disconnection in the loop, probably a core burnt away.

All connections in the loop should be clean and tight, and if it is necessary to use a bond at the end of the loop, this should be made short and heavy. If it is impossible to make good mechanical connections, sweating should be resorted to, but good mechanical joints can usually be made at feeder pillar and network boxes.

This brings us to the classes of fault where F.P. tests were necessary.

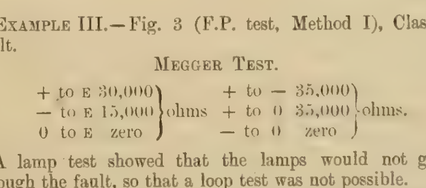

Fig. 3.

Example III.—Fig. 3 (F.P. test, Method I), Class 4 fault.

Megger Test.

+ to E 30,000, − to E 15,000, 0 to E zero } ohms
+ to − 35,000, + to 0 35,000, − to 0 zero } ohms.

A lamp test showed that the lamps would not glow through the fault, so that a loop test was not possible.

The reversing switch is an arrangement of three tumbler switches, whereby readings of the F.P. between *a* and fault and *b* and fault can be taken without reversing the galvanometer leads.

A 4-volt accumulator was switched on, and readings were taken quickly; an average of about six readings were always taken.

The method of calculating the distance to the fault is simple, thus:—

Length of loop, 6,525 ft., equivalent ...	·2 sq. in.
Deflection *a* to fault corrected for shunt ...	24
Deflection *b* „ „ „ ...	40·5
Distance of fault from *a*, 24 × 6,525/64·5 =	2,425 ft.
Being on the neutral, this is	1,212·5 ft.

The error was 12 ft., or ·55 per cent. on length.

There were no earth deflections in this test.

EXAMPLE IV.—Fig. 4 (F.P. Test, Method II).

This is an example of the method which was used for faults of Classes 1 and 2.

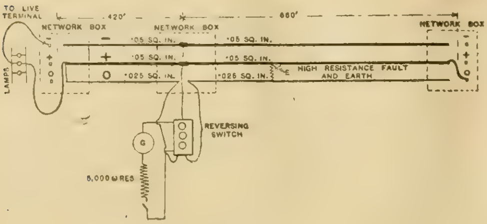

FIG. 4.

A length of sound cable is connected to the faulty length; this can sometimes be done through link or fuse boxes, or otherwise by cutting the faulty cable; readings of the potential drop when current is passed through as shown are taken, and the position of the fault is calculated.

MEGGER TEST.

$$\left.\begin{array}{l} + \text{ to E zero} \\ - \text{ to E } 100{,}000 \\ 0 \text{ to E } 1{,}000 \end{array}\right\}\text{ohms}\quad \left.\begin{array}{l} + \text{ to } -\ 100{,}000 \\ + \text{ to } 0 \text{ zero} \\ - \text{ to } 0\ 100{,}000 \end{array}\right\}\text{ohms.}$$

No current could be passed through the fault for a loop test, so this was treated as a Class 1 fault.

Length of faulty cable ...	660 ft. ·05 sq. in.
Length of sound cable ...	420 ft. ·05 sq. in.
Deflection sound cable	26·5
Deflection faulty cable	19·0

Length to fault 420 × 19/26·5 = 301·5 ft.

It was found advisable to deduct an allowance of 3 per cent. from the calculated length when using this second method with V.B. cables when the faulty cable was earthed; this is probably due to the added resistance near the fault, due to the cores being badly burnt.

Length to fault, corrected = 292 ft.
Error 1 ft. 6 in. = ·16 per cent.

In F.P. tests there will sometimes be earth deflections, and these must be added to or deducted from the galvanometer readings, according as they oppose or help the deflection when the test current is on.

It is a good plan to put a resistance of about 5,000 ohms in series with the galvanometer in these tests, and to regulate the test current so as to get a good readable deflection when the key is depressed; this saves a lot of trouble due to earth deflections, but all the same, if these are variable, it is almost impossible to get a reliable test, and therefore it is better to cut and try.

It is important in F.P. tests to keep the test apparatus well insulated from earth, and to see that the galvanometer leads are attached to the ends of the cable under test—*i.e.*, the testing circuit should not include any unavoidable joints; the joint between sound and faulty cable in Method II should be a good one.

In Class 2, faults using F.P. test, Method II, the history of the fault has to be roughly taken into account; if a bad burn out is suspected, which rather depends upon the fusing of the network and class of cables, a deduction of 3 per cent. should also be made, as in Example IV.

No examples have been given of F.P. tests on Class 3 and Class 5 faults, but they are only variations of the tests given in Examples IV and III respectively.

Electric Steel in New Zealand.—The Industries Committee of the House of Representatives has presented a report on the utilisation of steel scrap and waste. The Committee has had under consideration a proposal from Mr. Thomas Waddell, of Christchurch, to establish a plant for the melting of scrap steel by an electrical process. The Committee recommends the remission of Customs duty on the machinery for the erection of the electric furnace, and is of the opinion that the production of iron and steel in the Dominion is a matter which should receive the attention of the Government.

IRON COMMUTATORS.

By FREDERICK MURGATROYD, B.Sc. Tech.

THE fact that war conditions in Germany have necessitated a limitation of the use of copper and enforced the manufacture of iron commutators in certain classes of machines, raises the whole question of the commercial possibility of iron for this use after the war. Presuming that an iron commutator will always be cheaper than one made of copper, then, provided there are no insuperable commutation or mechanical difficulties in operation, we can safely assume that the iron commutator as a commercial proposition has come to stay.

Past experience of commutation problems, however, should deter us from making final decisions on this question from mere theoretical considerations. Commutation problems, electrical and mechanical, are so abstruse that only practical experience in the operation of iron commutators will supply the verdict as to their commercial future. And whilst British engineers will naturally watch developments in Germany, it would be wise for manufacturers here seriously to tackle the question of iron commutators on their own account.

The chief objection to this use of iron in place of copper is that a magnetic material replaces a non-magnetic. This means that we are adding to our already large list of commutation factors, a field produced in the iron segments due to circulating currents in the coils undergoing commutation. This field is radial, and coincides with the axes of the brushes. The effect is equivalent to increasing the reactance voltage, as this extra field has now to be neutralised before commutation can be completed. The result, therefore, is that with an iron commutator, either the lead of the brushes or the interpole strength must be increased. This portion of the subject has already been investigated in Germany, and it was found that in the case of a 100-KW. dynamo designed for 110 volts at 580 R.P.M., the short-circuit voltage in one coil was increased by 35 per cent. on replacing a copper commutator with an iron one.* The increase required in the interpole flux is stated as 10 to 15 per cent., and if this is so, it would seem that no serious alteration in the mechanical design of pole pieces or frame should be necessary, since interpoles are usually designed to operate well below saturation.

Apart from the above, the question would appear to be one for the brush engineer to solve, and he would find his problems very much aggravated. Sparkless commutation would be attained with much greater difficulty in view of the increased reactance voltage and the extra attention required to maintain a good polished commutator surface. Not only would great care be needed in the choice of the brush quality, but careful nursing would be a *sine quâ non*. In the latter connection, the first consideration would be that of the mica. It is, perhaps, safe to say that the majority of the brush troubles which are not electrical in origin, are traceable to obstinate mica. Mica protrudes for two reasons; either it works up due to the alternate heating and cooling operations it undergoes, or else the brush is insufficiently abrasive to wear it away at the same rate as it wears the copper segments. We so often speak of "hard" or "soft" mica, that we are apt to forget that "hardness" is no criterion of this "rate of wear." For ideal conditions the mica's resistance to abrasion should never exceed that of the metal segments, and, as already stated, the resistance to abrasion of any material bears no exact relation to its hardness as determined by any of the usual methods. Now, from experience gained in comparing the rates of wear of iron and copper or gun-metal rings with the same quality of brush on each, we can safely assume that an iron commutator would wear less than a copper one under the same conditions. It seems, therefore, that a more obstinate grade of mica would be possible, and this is a distinct advantage. With recessed mica the commutator might approximate somewhat to steel rings, with which some experience has already been gained. It is well known that certain grades of highly-graphitic brushes operate excellently on steel rings, giving a good polish to both ring and brush contact surface, and producing little ring or brush wear. It is quite possible, therefore, that highly-graphitic brushes would run well on slotted iron commutators, and the fact that such brushes are usually a good commutating type encourages this point of view.

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* Vide *Elektrot. u. Maschinenbau*, 35, pp. 273-276, June 10th, 1917.

With regard to the difference in friction coefficient and contact drops as a result of the change from copper to iron, it may be noted that German experience seems to show that there is practically no difference in the temperature rise of iron and copper commutators working under identical conditions. Whether this should be taken as fact, or whether German engineers are merely making a virtue of necessity, is certainly doubtful.

That iron commutators would require careful watching in operation is obvious, and, in certain situations, such as in hygroscopic atmosphere, the formation of rust may forbid the adoption of iron. Rust trouble, however, might be satisfactorily overcome by staggering the brushes, so that the brush paths cover the whole length of the commutator. Tendency to rust is, of course, the main objection to steel rings, for it has been found that a slight oxidisation generally occurs when the machine is allowed to stand, though, as mentioned previously, this is usually insufficient permanently to injure the good contact surface of the brush or ring. In the case of a commutator the oxidisation may usually be equally unimportant, and the use of an impregnated brush, by distributing a thin film of oil as a protective coating over the surface of the commutator, may be an effectual remedy in cases where the tendency to rust is excessive.

Trouble may occur with recessed mica owing to an accumulation of rust, or an oil and rust paste, in the slots of the segments, but this is not a detail which should present any difficulty in overcoming it, and in cases where the machine is rarely examined, the remedy would probably be to run on flush mica, using a suitable hard carbon brush.

As stated above, the commercial value of the iron commutator can only be finally settled after actual experience in its use; but judging merely from a theoretical standpoint, the iron commutator would seem to have a certain, though probably a very limited, future.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Meters on a Changed Frequency.

The question raised by "Query" in your current issue can only be correctly answered after one has heard what particular type of meter is in circuit.

A short time ago one of our largest meter manufacturers decided to test one meter of each type then on the market, and comparisons of all kinds were made, amongst them being that of variation with changes of frequency. Needless to say, vast differences were recorded as between types, and the errors were found to be increased on inductive loads.

The figures for two British and two Continental meters (all four in general use in this country) were as follows:—

BRITISH METERS.

		Half load P.F. 1·0.	Half load P.F. 0·5.
(*a*)	40 period,	1 per cent. slow.	4·0 per cent. slow.
	50 ,,	O.K.	0·6 per cent. ,,
(*b*)	40 ,,	1 per cent. slow.	3·5 per cent. ,,
	50 ,,	O.K.	O.K.

CONTINENTAL METERS.

(*c*)	40 period,	3 per cent. slow.	4 per cent. slow.
	50 ,,	O.K.	O.K.
(*d*)	40 ,,	2·4 per cent. slow.	6·0 per cent. slow.
	50 ,,	0·4 per cent. fast.	2·6 per cent. fast.

Unless, therefore, the majority of meters in question are of Continental origin, or the circuits are mostly for power purposes, there is no need for "Query" to worry about the change of frequency. Certainly no method of voltage variation will compensate, because A.C. meters are all watt-hour meters, and, therefore, as regards accuracy are independent of voltage variation.

T

Urmston.

Illuminating Engineering.

The criticism of your correspondent on my address to the Illuminating Engineering Society is welcome, and for any discussion on it I should be grateful.

Mr. Cook suggests that I encourage the idea that an engineer "has done his duty to himself in accepting the sense of sight as judgment from one whose mind he has omitted to tutor in its requirements." I thought that I had already wandered too far into psychology and other philosophical matters, and I hesitate to enter into the extremely interesting question of the intellectual relations which do, might, or should exist between a professional man and his client. Business is started by a statement by the client of what he thinks he wants. Sometimes he knows this so exactly that the engineer has only to see that he gets it. At other times, the engineer must amplify the details by investigation into the case, and forms his own opinion, based on technical experience, on what he judges that his client really wants. It is rather a delicate matter to act as a tutor, or to do more than "elucidate" qualities to him. If he "preaches" "subordinate diversity factor" and "the loss of intrinsic brilliancy as reduction in illumination," to quote Mr. Cook's words, he may weary, or even annoy, his client, unless a good deal of tact be used. May I quote another part of my address? "Even if an instrument should one day be invented, as Lambert hoped, which would indicate a quantity of light on a scale like a thermometer, our client's opinion of the lighting will not be materially influenced. Illuminating engineers must, therefore, give some attention to the subjective, and to physiological interpretations of sense-impressions." The boot-maker cannot tell where the shoe pinches, but a knowledge of the anatomy of the foot will help him to give relief. The oculist may preach to any extent, but the patient will generally insist on having glasses which help him to see better. And so with all the senses.

"The more liberal education from engineers, direct to the public," to which Mr. Cook alludes, is one of the main objects of the Illuminating Engineering Society, and its enthusiastic honorary secretary is great on propaganda. But a good deal may first be done among engineers themselves if they can be induced to study the subject. Like other branches of optics, it offers pegs on which mathematicians are tempted to hang festoons of formulæ, pretty problems, and elegant equations, and neologists to adorn with lumens, lamberts, and milli-phots. But the more practically minded engineer applies simple measurements to actual cases, much as we used to design dynamos a third of a century ago, and build up experience thereon.

In this connection I should like to comment on Lieut. Stroud's criticism on page 586 of the review on "Modern Arc Lamps and Incandescent Lamps." He rightly suggests that in the absence of any information about the kind of opal glass, exact comparisons of semi-indirect, and of direct lighting are not possible. But in his final paragraph he says that "the proper comparison should have been made with the most efficient type of open reflector," when it will be found that "semi-indirect lighting is 40 per cent . . . dearer than direct lighting." The introduction of the reflector complicates the comparison. The first question is to find the loss of light, if any, due to the use of an opal bowl or hemisphere.

I use such bowls in my house, and there is one in one of the rooms at the offices of my firm. I have made measurements of the illumination received on the tables below these lights. At home I use Ediswan "Downlite" lamps in sand-blasted opal bowls, procured also from the Edison & Swan Co. The ceiling has not been whitened for nearly four years.

With the bowl, the illumination on the table from one light only was 0·62 ft.-candle. On removing the bowl it was 0·65 ft.-candle. The direct illumination was, therefore, 5 per cent. greater than the indirect. With the bowl in place, the brightness of the ceiling nearly over the lamp was equivalent to that of a white screen receiving an illumination of 3·6 ft.-candles. With the bowl removed it was 1·6 ft.-candles. At my offices the difference on the table was less, and was barely measureable. The brightness of the ceiling, which was whitened about four months ago, was 2·8 with and 1·6 without the bowl.

The light reflected from the bowl to the ceiling, and again reflected downwards, depends on the reflecting power of the opal glass and on the solid angle subtended by it. The light received directly from the under surface of the bowl depends on the intrinsic brightness of the glass. In my house the lamps are deep down in the bowls. Raising a lamp 2 in. causes an increase of the portion of the ceiling illuminated, but reduces the brightness of the glass so much that the illumination on the table is reduced from 0·65 to 0·49. I was unaware of the importance of the position of the lamp in the bowl until I made this simple experiment.

A. P. Trotter.

Westminster, *January* 11*th*.

Distinctive Colours for Braided Cables.

It gives me very great pleasure to again acknowledge the receipt of the good old REVIEW for the period since my last letter. It has turned up with clockwork regularity except when we have been on the move, when it follows up a day or so later than usual. It is appreciated as much as ever by all the electrical men of this section. With reference to the letter on distinctive braidings for V.I.R. cables, by your correspondent Mr. T. D. Spark, I should like to add my appreciation of his suggestion. Since I have been in France I have used a quantity of yellow braided cable. Perhaps it would be more correct to say yellowish-brown. This is the colour your correspondent suggests, but I rather fancy this wir was of French manufacture. French electricians use a lot of this cable for electrical installations, so it is quite possible that British firms manufacture cable of the same colour for the French market. Wishing you the compliments of the season.

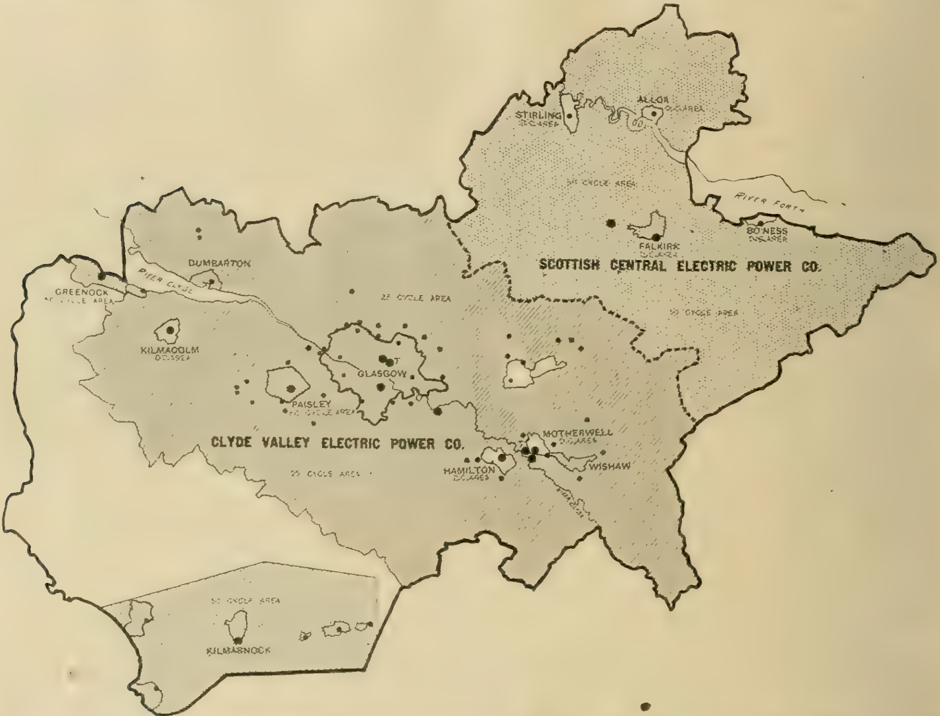
Harry Payn,
London Electrical Engineers.

B.E.F., France, *January 5th*, 1917.

WEST OF SCOTLAND LINKING-UP.

In our last issue (p. 46) we published a fairly full abstract of the report of the West of Scotland Committee for the interconnection of electricity supply undertakings.

Through the courtesy of Mr. F. H. Whysall, chief electrical engineer, Greenock, and hon. secretary of the Committee, we are now able to reproduce a map of the area referred to and a summation load curve showing the combined week-end loads of the undertakings concerned for which provision would be made by interconnection. We also append a table giving particulars of the undertakings in the area covered by the map. Readers are referred to our last issue for details of the report, which briefly divides the undertakings into four groups—A, B, C, and D—and further into joint groups of A and B, and B and D, these being denominated E and F respectively. Group A comprises the Paisley, Greenock, and Kilmarnock undertakings; Group B, the Glasgow and Clyde Valley Power Co.'s undertakings; Group C, Alloa, Bo'ness, Falkirk, and Scottish Central Power Co.'s undertakings: Group D embraces all direct-current undertakings, and no linking-up is proposed; Group E includes the Clyde Valley Power Co. and Paisley; and



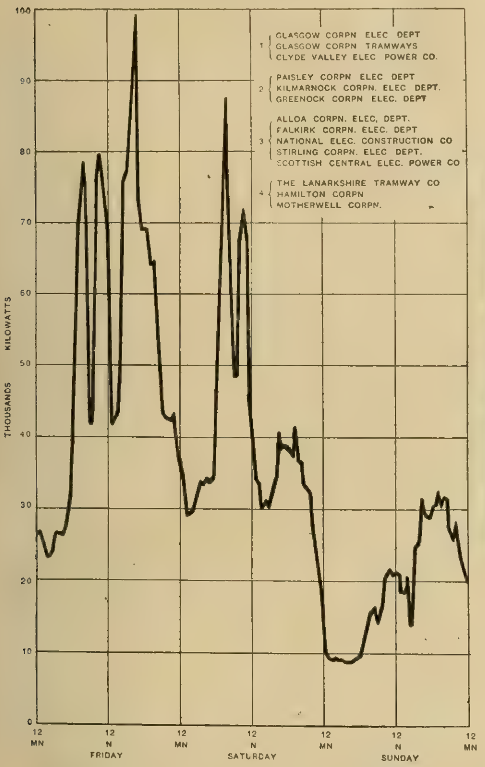
Map of West of Scotland Area: Boundary Suggested by National E.P.S. Committee Shown Dotted.

Particulars of West of Scotland Electricity Undertakings.

Undertaking.	System.	Voltage.	Max. load, KW. Winter, 1916-17.	Generators, KW.	Boilers, KW.	Spare boilers at peak load, KW.	Remarks.
Alloa	D.C.	440	668	1.201	Gas plant	—	—
Bo'ness	D.C.	460	700	1.000	800	100	Leased to Nat. Elec. Const. Co.
Clyde Valley Power Co. (Motherwell, Yoker, and Clydesmill)	3-p. 25 c.	11,000	25,000	40.000	33,000	8,000	Bulk supplies to Wishaw, Coatbridge, Airdrie. Dumbarton; other towns and villages are supplied; 20,000-KW. extension in progress.
Falkirk	3-p. 50 c.	6,600	950	1,500	950	—	—
Glasgow...	3-p. 25 c.	20.000	45.000	55,000	55,000	10,000	Extensions of 30,000 KW. are in progress; systems are linked-up.
Glasgow (tramways)	3-p. 25 c.	6,500 6,600	18,000	22,500	18,000	—	
Greenock	3-p. 50 c.	10.500 3,300	7.800	14.000	12,000	3.500	Includes supply to Port Glasgow.
Hamilton	D.C.	480	1,180	1.180	1,500	700	—
Kilmarnock	3-p. 50 c.	11,300 3,300	3,500	5.000	5.000	1.500	Supply to towns and villages in district.
Kilmacolm	D.C.	480	75	175	200	—	—
Lanarkshire C.C. (Cambuslang)	D.C.	500	—	—	—	—	—
Lanarkshire Tramways Co. ...	D.C.	520	790	825	1,200	—	850 KW. purchased from Clyde V.P. Co. (not included in maximum demand).
Paisley	2-p. 50 c.	2,000	2,500	6.400	3.500	1.000	—
Motherwell	D.C.	500	1,900	2.940	3,200	—	—
Scottish Central Power Co. (Bonnybridge)	3-p. 50 c.	6.600	3,000	6.000	3.500	500	Bulk supply to Denny; other towns and villages supplied.
Stirling	D.C.	460	360	620	—	—	—

Group F the same company and the Lanarkshire towns in Group D.

The cost of providing links of maximum utility under existing conditions is estimated at £134,870, and the annual saving is put at £19,140, or omitting Group B, the outlay would be £118,870 and the estimated saving £9,140 per annum.



Composite Week-end Load Curve of Undertakings Mentioned.

The Committee consists of Mr. George Balfour (chairman), Mr. F. H. Whysall (vice-chairman and hon. sec.), Messrs. R. A. Brown, G. F. Moller, G. Salter, J. Wishart, C. F. Parkinson, F. Coutts, Roland Marshall, C. T. Astbury, J. Dalrymple, J. White, Thos. Ross, D. A. Starr, H. E. Ferguson, H. C. Babb, J. W. Napier, J. W. Papworth, W. C. Benson, E. T. Goslin, W. W. Lackie, A. Page, F. J. Launchbury, and H. Dixon.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Three-Phase Live-Roll Motors.

The standard motor designed for ordinary electric driving purposes is totally unsuitable for operating live-roll gear and other auxiliary machinery in a steel works. The motor must have exceptional mechanical strength to withstand the frequent shocks experienced in consequence of the heavy loads suddenly thrown on the motor, the continual rapid reversing, and through the vibration of the gearing. Such a motor must, moreover, be totally enclosed to exclude metallic and other dust which abounds in steel works, and must at the same time have but small rotational inertia, in view of the fact that it may be called upon to stop and start as many as 500 times an hour in the course of its normal duty. In addition, the motor must be capable of rapid dismantling for inspection, overhauling, or repairs, enabling any adjustment to be carried out in such a way that stoppage of the plant is reduced to a minimum.

In three-phase installations a special form of induction motor is required to meet the conditions outlined, and the General Electric Co., Ltd., have undertaken the manufacture of this class of machine; fig. 1 shows some of these machines, which are the first special live-roll induction motors to be manufactured in this country, and form part of a large contract for an important new works in the North of England.

The method of taking the motor adrift is explained in fig. 2, which at the same time displays the special constructional features. The external carcase is in two halves, and is of strong and heavy construction. With the removal of the bearing caps and bolts holding together the two portions of the carcase, the upper portion can be lifted clear, carrying with it the brushgear and the rotor leads. With this done, eyebolts are exposed which are permanently secured to the bearing bushes in which the rotor shaft runs, the bushes being bolted together inside the shell. By attaching the crane slings to these two eyebolts, the bushes can be lifted out, carrying with them the rotor and the stator.

The stator is composed of a separate ring of laminations built up in a containing frame and self-contained with the windings. After being lifted out of the bottom half of the carcase the rotor can be lowered to the ground and slid out of the stator. This arrangement makes it possible, in the case of an accident to either rotor or stator, to take the machine adrift and insert either a spare rotor or stator complete in less than half an hour, without loosening the holding-down bolts.

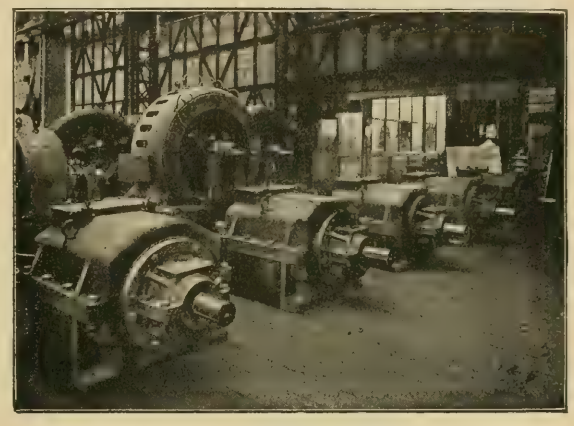


Fig. 1.—"Witton" Rolling-Mill Induction Motors.

The conductors are of the bar type both in rotor and stator, and are insulated with moulded mica. They are thus capable of withstanding high temperatures without deterioration, the insulation being at the same time non-hygroscopic.

In these machines mechanical considerations have first claim; the air-gap has therefore been made exceptionally large, being 0·1 in. (radially) in the 75-h.p. motor. Otherwise every care has been taken to give a high power-factor, and the machine is so designed that the power-factor increases on overload, at which time a good power-factor is of the most importance.

The motors are capable of withstanding a very heavy overload. They have a starting torque of 2·5 times normal and a high stalling point. Very substantial bearing bushes are provided lined with white metal, and very liberally designed. The journals in a 75-h.p. motor are never less than 5 in. in diameter and 12½ in. long. The slip-rings are of phosphor-bronze, of very large diameter, the brushes being arranged to carry the current continuously without short-circuiting.

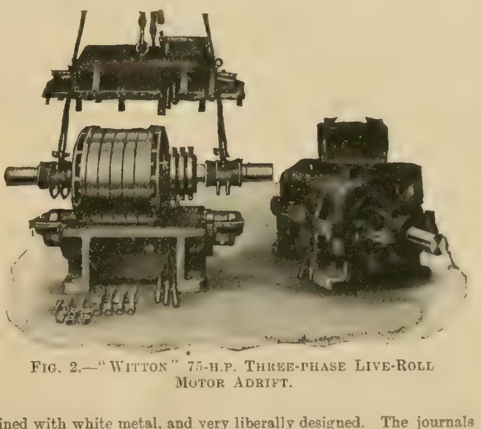


Fig. 2.—"Witton" 75-h.p. Three-phase Live-Roll Motor Adrift.

In order to permit of rapid acceleration, retardation, and reversing, the rotor has been constructed of small diameter, and has therefore a small moment of inertia. To avoid breakage of the connections, the rotor is mounted on a spider which also carries the slip-rings.

The motor is symmetrically constructed, and the shaft is extended equally at each end. Not only can the drive be taken from either end of the machine when first installed, but if by any chance the shaft at one end of the machine becomes damaged, the motor can be turned round on its foundation bolts and can then drive from the other end, the centres being exactly the same. The extension end can also be used, if necessary, for a solenoid brake.

This class of machine is being satisfactorily used in steel works, not only for driving live rolls, but also for cranes and other auxiliary machinery.

Automatic Circuit-Breakers.

The British Thomson-Houston Co., Ltd., of Rugby, have issued particulars of a line of automatic circuit-breakers for A.C. and D.C., for use in heavy service up to 6,000 amperes at 650 volts. In addition to their usual standard designs, the makers have provided a free-handle tripping device and novel features in minor details, including a number of attachments to give automatic operation on overload, low voltage, reverse, shunt trip, and combined overload and reverse, as well as a time-lag on overload combinations. Auxiliary switches can be fitted for opening or closing an auxiliary circuit when the breaker operates, and any of the foregoing attachments can be added to circuit-breakers supplied without them, no alterations being necessary.

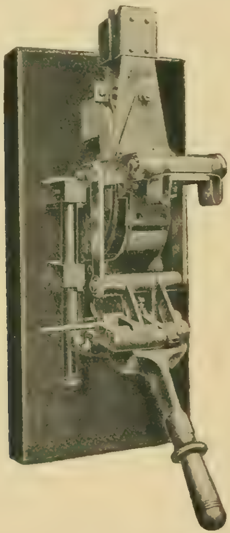


Fig. 3.—B.T.H. 2,000-Ampere Circuit-Breaker, Type V, Form B. Closed Position.

Double and triple-pole combinations can also be arranged for higher ratings. Fig. 3 shows a 2,000-ampere S.P. breaker, with overload and time-lag attachments and patent blow-out shield. A powerful double-toggle mechanism is employed for closing the breakers, of the free-handle and quick-break type, without auxiliary springs; the main contacts are of laminated copper, with auxiliary copper contacts and supplementary carbon contacts, which are renewable. All arcing takes place at the top of the circuit-breaker. The time-lag is of the dash-pot type, adjustable over a wide range, independently of the overload rating, and gives an inverse time characteristic.

THE FRENCH BAUXITE AND ALUMINIUM INDUSTRY.

According to articles which were published recently by the Paris *Information*, the French production of bauxite prior to the war represented 60 per cent. of the total output throughout the world, the United States occupying the second position in this respect. The red bauxites mined in the South of France contain from 57 to 60 per cent. of alumina, and only from 2 to 4 per cent. of silica, and are therefore highly valued by makers of aluminium. In 1913, which was the last year of normal working, the production of bauxite amounted to 309,294 tons, as compared with 196,056 tons in 1910. Out of the total, 258,074 tons were raised in the region of the Var, 43,800 tons in the Hérault, 4,270 tons in the Bouches-du-Rhône, and 3,150 tons in the Arièze.

A portion of the tonnage of red bauxite extracted was consumed in France by the aluminium works spread over the Valley of the Arc, after the ore had been treated in works installed in proximity to the deposits at Gardanne (Société Electro-Métallurgique Française), Salindres and Beaucaire (Société d'Alais et Camargue), the Barasse, near Marseilles (Société d'Electro-Chemie), and Saint Louis, near Marseilles (Aluminium Français). These alumina works absorbed 100,900 tons of bauxite in 1911, 121,000 tons in 1912, and 143,000 tons in 1913, whereas the consumption in 1909 only amounted to 40,000 tons. Although the tonnage worked up in the country increased by over threefold in five years, the exports were of considerable volume, the figures passing from 14,000 tons in 1910 to 151,000 tons in 1911, 138,000 tons in 1912, and 168,000 tons in 1913, which last quantity was in excess of the home consumption in that same year. The principal customers in 1913 were Germany, which received 82,500 tons, of which 31,000 tons were sent direct, and the balance *viâ* Holland; Great Britain, 52,600 tons; Belgium, 10,900 tons, which were probably also sent on to Germany; and the United States, 12,000 tons. It will thus be seen that Germany purchased about 55 per cent. of the French exports, and Great Britain 30 per cent.

The working of the bauxite deposits at the beginning was embarked upon by purely mining companies for the purpose of supplying the market with ore, but in the course of time the producers of aluminium began to acquire mines in order to reduce their prime costs. Thus the Société Electro-Métallurgique Française, of Froges, obtained possession of the Caire and Beaume-Saint Michel properties at Mazaugues, the Société d'Alais et de la Camargue purchased rights at Loupian and Engardin (Tourves), and subsequently secured the deposits at Bedarieux by the absorption of the Société Métallurgique des Pyrénées. The British Aluminium Co. obtained control over the Union des Bauxites, whilst the Aluminium Industrie Gesellschaft, of Neuhausen, formed a branch under the title of the Aluminium Français, and made purchases at Thoronet, Vins, Camps, and Mazaugues. The operations of the latter, however, were unfortunate. After having extracted 40,000 tons the company found that it had made a mistake, but subsequently effected the purchase on the Marseilles Exchange of the majority of the shares in the Bauxites de France, with the object of obtaining supplies for the works at Neuhausen and Chippis. The board of directors of the Bauxites de France was reorganised by the Neuhausen company in July, 1914, which was the eve of the conflict.

Our French contemporary proceeds to state that the mining of bauxite has been more affected by the war than all the other branches of mining, as, despite the increase in the consumption of aluminium, the production of bauxite has considerably decreased. By way of explanation of this apparent inconsistency, it is mentioned that prior to the war the companies had accumulated large stocks of bauxites, which were drawn upon when labour became scarce, one company alone having stocks on hand amounting to several hundred thousands of tons. Moreover, the domestic consumption of bauxite has decreased, as various aluminium works have adopted other branches of manufacture. On the other hand, the war has arrested all exports to Germany, Holland, Switzerland, and Russia, whilst the high level of freights rendered business with the United States out of the question until the issue of an export veto on ores.

It is considered that although the war has dealt a heavy blow to the bauxite industry, the latter has a promising future in the era of peace, even if the more extended use of aluminium were merely limited to aviation and automobilism. But the future would be for ever compromised if the pre-war policy of continuing to supply Germany directly or otherwise were continued, and if measures were not taken, the newspaper concludes, to limit exports to countries associated with France in the defence of liberty and civilisation.

WAR ITEMS.

Trading with the Enemy.—The "London Gazette" for January 11th contains a very lengthy list of persons and bodies in Mexico with whom trading is prohibited.

Lighting Conditions in Petrograd.—The "Times" correspondent at Petrograd gives the following account of the gloom that prevailed on January 11th and 12th in that city:—"I am writing this message by the light of one candle, which the waiter warned me would cost two roubles 50 (5s. normal exchange). The gloom of the hotel corridors is intensified by lamps the size of nightlights placed at awkward turns and corners. Outside it is 20 degrees below zero, and inside one feels that the temperature is about the same. At 10 o'clock last night the electric light was turned off, and since then, excepting for five hours' daylight, we have been kept in darkness. Many parts of the city are in the same condition owing to the approaching exhaustion of fuel."

Control of Imports and Exports.—A meeting of merchants at Birmingham passed a resolution urging that, whilst it acquiesced in the control of imports and exports as a war measure, such control should cease except with enemy countries and subjects at the earliest possible moment consistent with national interests. That seems to us to be the same attitude as Sir Albert Stanley took up when resisting opposition to the Control of Imports and Exports Bill.

Exemption Applications.—The case of an electrical engineer at a war hospital came up before the West Riding Appeals Tribunal, at Leeds, against the decision of the Harrogate Tribunal. Applicant was married and B 1, and would have to report for service on February 15th. It was stated that the Furness Hospital (the place of employment) was being used for wounded soldiers, and 15,000 electrical treatments had been given there. The appeal was, however, dismissed, but the man is not to be taken away until a substitute had been found.

At the Shoreditch Tribunal, on Friday, the Mayor, Coun. H. Busby Bird, J.P., in the chair, Messrs. Osmond & Matthews, Ltd., of 13-29, Hearn Street, E.C., wholesale importers and factors of electrical goods, appealed for seven ledger and invoice clerks, a packer, a cashier and salesman, a carman, two stock-keepers, and a commercial traveller, the last of these also having a personal appeal. Mr. Wakeling said that on the ground that they had sucked the firm as dry as possible, he moved that the men be granted four months each. Another member pointed out that there were two clerks, aged 36 and 40, who were both B 1, but Mr. Wakeling said it did not matter; they had been through the lists so often that the orange was sucked dry. Finally it was decided to grant four months all round, with the previous V.T.C. conditions.

At Runcorn, on January 7th, two apprentices, aged 18, were appealed for by the Electric Light & Power Co. The Military Representative opposed, on the ground that the youths were neither skilled nor indispensable. A representative of the company said that after two years' service at the trade the youths could not be called unskilled. The Military Representative replied that they might be useful to the company, but they ought to be in the Army. The Chairman: But they are also of use to the Council and public of Runcorn. The company's representative said that they had lost nine men, and had 11 left. The area of supply included Runcorn, Widnes, Frodsham, and Helsby. Conditional exemption was granted in each case, with the Volunteer condition.

At Windsor, on January 3rd, Mrs. Fowler, wife of Mr. H. Fowler, electrician, renewed an appeal for the retention of F. J. Isgrove (18), apprentice in the business, Mr. Fowler being in the R.F.C. Mrs. Fowler stated that she had been unable to find anyone to take the youth's place. The firm was the only one of its kind in Windsor, and Isgrove and a lad of 16 were the only two left to do the work. When her husband joined the R.F.C. the conditions were that they should keep the foreman, but he had also gone. The Tribunal granted a month's respite for arrangements to be made with the Civil Liabilities Commission.

At Kendal, the Corporation electricity department opposed an appeal by the Military against absolute exemption held by an electrical engineer (41), on the ground that he was engaged in a public utility service. The certificate was amended to exemption until May 15th.

At Maidstone, three months' exemption was granted to H. Upton (30) and H. G. Tomlin (33), both passed for general service, coal unloaders at the Municipal electricity works.

The Sheffield Tribunal has granted exemption until June 30th to H. E. Maxey (38, Grade 3), electrician at the King Edward VII Hospital.

At Oxford, the National Service Representative applied for the withdrawal of exemption held by D. Campbell (38, B 1), traffic superintendent; T. Smalley (32, B 1), inspector and driver; and V. Hill (36, B 1), inspector and driver; employed by the Electric Tramway Co. The company applied for extended exemption for A. W. Oakley (37, Grade 3), unit adjuster and smith. Captain Sheild agreed to three months' temporary exemption for Oakley and Campbell, and in the cases of Hill and Smalley he contended that it was no longer necessary in the national interest for the men to remain in their present occupations. Inspectors' work could easily be done, as it was in London, by women. It was pointed out that the two men were not only inspectors, but experienced drivers and mechanics, and were now more important to the company then ever they were before. They had six inspectors before the war; now they had these two, and two female ones. They were reduced to the lowest possible margin. Oakley and Campbell were each exempted for three months, and Hill and Smalley for two months.

Before the Northants Appeal Court, the National Service Representative opposed exemption granted by the Northampton Tribunal to F. L. Perrin (26, Class A), electrical engineer, who has two businesses, and has a number of contracts in hand, on the ground that he had working for him five men and a boy. A final three months was granted.

LEGAL.

Action Against Tynemouth Electric Traction Co., Ltd.

At North Shields County Court on 11th inst., W. H. Brown, master boiler-cleaner, and J. A. Southern, miner, brought an action against the Tynemouth Electric Traction Co., Ltd., to recover damages for personal injuries received in a tramcar accident at Whitley Bay, on July 22nd last. Brown claimed £24 and Southern £15, and the company admitting liability, had paid into court £5 in Brown's case, and £3 in the case of Southern.

Brown stated that while travelling from North Shields to Whitley Bay on the top of a car, the trolley slipped from the wire. Southern and he were sitting together, and the trolley struck both of them on the head. He was ill for some days, and could not sleep at night. He did not consult a doctor until August 21st, when he saw Dr. Mort, of Middlesbrough, who gave him some medicine.

The Doctor, in reply to the Judge, said he gave Brown a "stomach" bottle.

The Judge said he thought the company had behaved very liberally in paying into Court the amount they had done. He gave judgment for the defendants. In the case of Southern it was stated by his solicitor that the amount paid into Court would be accepted. Judgment was entered for the defendants in each case with costs.

Electrical Engineer Fined.

At Warrington Police Court last week, Henry Tinsley, electrical engineer, of South Norwood, London, stated to be engaged on important work for the Government, was charged with having made a statement likely to cause disaffection, or to interfere with the success of H.M. Forces.

Mr. Thomas A. Moss, living at the Lion Hotel, stated that on November 9th, while having supper there, he heard the defendant ask the landlady as to troops leaving the district. The defendant, who was staying at the hotel, was heard to tell the landlady that the war would soon be over, and we should have to make the best terms we could. He also made other statements to the witness. The defendant denied having said anything about Germany having won the war. What he said was that we had a hard engineering problem in front of us, and we had to put our backs into it before we could get through.

Mr. Dodd, defending, said that if everybody was to have his conversation picked up and brought into a police court we should not know where we were. A fine of £25 was imposed.

Electrical Firm Fined.

At Manchester City Police Court last week, Messrs. A. W. Taylor and Co., electrical engineers, New Brown Street, were fined £3 for failing to exhibit a list of employés as required by the Defence of the Realm Act.

BUSINESS NOTES.

Plant for Sale.—Battersea Borough Council Electricity Department is inviting tenders for several steam dynamo sets in good condition. For particulars see our advertising pages to-day.

Fire Prevention.—Messrs. Associated Fire Alarms, Ltd., of Jewin House, Redcross Street, E.C. 1, have sent us particulars of a number of cases in which their automatic apparatus has recently prevented serious damage from being incurred through outbreaks of fire. In one instance, owing to the bearings of a hoist heating, the dust and fluff over the hoist became ignited, and within two minutes the Fire Brigade was on the spot. In several other cases the Fire Brigade was directly summoned by the apparatus in time to prevent the spread of incipient fires, and one alarm was given in the course of an air raid, saving an important building from destruction.

Manufacturers' Meeting.—The annual meeting of the National Union of Manufacturers (Inc.) is to held on Wednesday, February 6th, at 12 o'clock, at the offices, 6, Holborn Viaduct, E.C. 1. The secretary's report which will be submitted for adoption, shows that the Midland Branch, with offices at Birmingham, is making rapid progress. Local manufacturers are being canvassed, and many new members obtained. Trade sections of the Association are being formed. The present membership represents between £500,000,000 and £600,000,000 capital and from 350,000 to 400,000 workpeople. A questionnaire issued by the Association shows that a State Bank to help to assist the smaller manufacturers is an absolute necessity.

Cable Works Extension.—The *Gloucester Journal* states that the works so successfully carried on for some years past, adjacent to the banks of the river Wye, at Lydbrook Junction, by Messrs. H. A. Smith & Co., Ltd., electrical wire and cable manufacturers, have been recently enlarged, and special provision has been made for the comfort and convenience of the 250 employés. There is a spacious dining hall, cloak and bath rooms, lavatories, &c. A social gathering was held at the works recently, when the workpeople's appreciation found expression in the presentation to Mr. Smith of a solid silver inkstand, while Mrs. Smith was the recipient of a silver salver.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVI. No. 12. December, 1917. New York: The Institute. Price $1.

"Science Abstracts, Sections A and B." Vol. XX, Part 12. December 31st, 1917. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Elementary Mathematics and their Application to Wireless Telegraphy." By S. J. Willis. London: The Wireless Press, Ltd. Price 3s. 6d. net.

"Engineering Mathematics." By C. P. Steinmetz. London Hill Publishing Co. Price 12s. 6d. net.

"The Silewani-ghat Hydro-Electric Power Project in the Chhindwara District." By E. Batchelor. Allahabad: The Pioneer Press. Price 2 rupees.

"Short Logarithmic and Other Tables." By W. Cawthorne Unwin. London: E. & F. N. Spon. Price 1s. 6d.

Liquidations. — Armorduct Manufacturing Co., Ltd.—Creditors must send in particulars of their claims, &c., to Mr. J. Paterson, 1, Walbrook, E.C. 1, Controller, by February 1st.

Rotherham Electrical Engineering Co., Ltd.—A petition for the winding up of this company has been presented by Mr. J. Grout, of Hastings, and is to be heard at Sheffield on January 24th.

Turner & Burger, electrical accessories merchants, London, E.C.—The controller, Mr. J. E. Percival, has applied to the B. of T. for his release.

Climax Stopper and Ebonite Co., Ltd.—Meeting of creditors, January 28th, at Great Eastern Hotel, London, E.C.

Trade Announcements.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., announce that the address of their Birmingham branch is now Broad Street Chambers, Birmingham, instead of Edmund Street.

Mr. Chas. Melvin, who has been discharged from the Forces, has started business at 70, Westcombe Hill, Blackheath, S.E. 3, as Chas. Melvin & Co., for the sale of electric lamps, torches, batteries, fittings, &c. He asks for calendars and showcards from electrical manufacturers of these lines.

The Edison Battery Co. (U.S.A.).—The Edison Battery Co., of Orange, N.J., U.S.A., is increasing its capital from £700,000 to £1,000,000.

Bankruptcy.—G. E. Hipkins, electrical engineer, Dudley.—Application for discharge to be heard on February 5th, at Dudley.

C. B. Ogilvie, electrical engineer, Whalley Range, Manchester. —Trustee, Mr. J. G. Gibson, released January 7th.

Smith, W. T., electrical and mechanical engineer, Bolton.—Receiving order made January 9th on a creditor's petition.

Calendars.—We have received from Messrs. Pirelli, of 144, Queen Victoria Street, London, E.C., one of their wall cards for 1918, a graphic representation of their tires in the motor service of the Italian Forces appearing above a block of daily slips with the date in large red figuring. The firm will be pleased to send a calendar to any of their business friends who may have been overlooked.

From Messrs. Home & Rowland, Troughton Road, Charlton, S.E., we have received a quite artistic little desk calendar, with tear-off quarterly date slips, each bearing a coloured representation of vessels at sea—in peace-time.

Concert.—The employés of the Phœnix Dynamo Co. gave a concert in the Central Hall, Bradford, on Saturday last, in aid of Relief Fund and the Wounded Soldiers' Fund. The orchestra and most of the artistes were drawn from the employés themselves, and the affair was a pronounced success. The workpeople from these works have been very active in their charitable relief work during the war.

Sweden.—A new company has lately been formed in Sweden to establish works at Västeras for the electrolytic production of copper, nickel and cobalt.

Catalogues and Lists.—Messrs. Cole, Marchent and Morley, Ltd., Prospect Foundry, Wakefield Road, Bradford.—Catalogue No. 52 (32 pp., art paper), containing descriptive illustrated matter relating to their slow-speed horizontal steam engines, with piston-drop valves operated by detent gear for superheated or saturated steam. All the main parts of the engines are illustrated, and a general specification and tables of standard sizes are given.

British Insulated and Helsby Cables, Ltd., Prescot.—Pamphlet P. No. 149, gives brief illustrated particulars and prices of Prescot fuse-boxes (Home Office type).

LIGHTING AND POWER NOTES.

Accrington.—The Trades and Labour Council has passed a resolution disagreeing with the suggestion of the Coal Conservation Committee that electricity supply should be left in the hands of private enterprise, and expressing the opinion that it should be owned and controlled by the nation.

Ashton-under-Lyne.—The Corporation has granted a war bonus of 12s. a week over pre-war wages to its employés; Heywood Corporation has given a similar increase, and Blackpool Corporation has agreed to a 16s. war bonus in the gas and electricity departments, and 14s. in the others.

Australia.—The Sydney City Council Electricity Committee recommends that, owing to the restrictions of window and shop lighting, the monthly charge for arc lamp hire only be reduced to 1s. 8d. per lamp per month during the period the arc lamps are not in use.

The Sydney Electricity Committee also recommends that in connection with the supply of electricity to consumers without meters as a temporary measure, the following schedule of charges be approved:—Lighting, varying from 6d. to 2s. 8d. for every 40-watt lamp, or smaller, per month, and for larger sizes *pro rata*. Power from 1s. 10d. to 7s. 9d. per kw. connected load per month (factories based on eight hours' daily working).—*Tenders.*

Tenterfield (N.S.W.) Electric Lighting works were opened recently by the Mayor, Ald. W. F. Stewart, and the light switched on. In the course of his remarks the Mayor stated that the cost amounted to £8,000, being £2,000 above the original estimate, owing to the increased cost of machinery.

Ballymoney.—E.L. Proposal.—At the monthly meeting of the Council, the secretary of the local gas company wrote that the charge for lighting would be 7d. per unit and half that for power. Mr. J. M'Clenaghan, electrical engineer, who has a lighting scheme under consideration, wrote that he would supply electric light at 7d. per unit, with a sliding scale based on annual consumption, regulated by discounts for large consumers, and 5d. per unit for power. A proposal to allow Mr. M'Clenaghan to erect poles in connection with his scheme was negatived.

Barnes. — Proposed Extensions. — The electrical engineer has submitted plans and an estimate for the projected extension of the works, together with a report which estimates the cost under present circumstances at £12,500; the matter was referred to a Sub-Committee.

Bradford-on-Avon.—The time for making the transfer authorised in the Electric Light Order of 1914 is extended to January 30th, 1919.

Bristol.—Proposed Extensions.—A special meeting of the T.C. was held, last week, to consider a report from the Electrical Committee asking for permission to raise further capital for extensions. Special interest was centred in the meeting, due to a letter having been inserted in the local Press by Mr. Chas. Wills (a former chairman of the Electrical Committee but now in the ranks of the Anti-Municipal Traders) calling upon every member of the Council to vote against the adoption of the report. The report was for the provision of a 6,000-kw. turbo-generator and accessories, together with four boilers. In presenting the report, Alderman Pearson expressed surprise that Mr. Wills did not communicate with the staff to obtain some information with regard to the present application to spend £76,000; had he done so, it was unlikely the Council would have been troubled by his letter. In 1914 they applied for sanction to install a 6,000-kw. set. Owing to the energies of the opposition, it was refused, and a 3,000-kw. set only authorised by the B. of T. They had room in the building for a 6,000-kw. set, but could not put two 3,000-kw. sets in the same site. Hence they had wasted the ground in the works. In addition, they were now compelled to get the larger plant, and it would cost them £10,000 more than three years ago. They had also to find a site for it; £10,000, therefore, did not measure their loss.

Burley-in-Wharfedale.—The Council is supporting the Keighley Corporation in opposition to the Yorkshire Electric Power Co.'s Bill, and has intimated willingness to join with the Urban District Councils' Association, or any other organisation, in opposing the same. The Council has also decided to support the resolutions of the Rural District Councils' Association against the Provisional Order applied for by the Electrical Distribution of Yorkshire, Ltd.

Cheltenham.—Price Increase.—The electricity charges, which were increased by 5 per cent. last May, are now to be raised another 10 per cent.

Continental.—Turkey.—According to a report from Constantinople, received through a neutral country, a good deal of speculation in land is just now taking place in both European and Asiatic Turkey, in view of the industrial developments that are expected to take place when the war is over. This is said to be particularly the case at Smyrna, at Konia, and at Eskichir, where, in the case of the last two-mentioned towns, projects for the establishment of central electric lighting stations and tramways are stated to be under consideration. A new electricity station is also in course of construction at Liban, while at Karahissar, the junction town on the Anatolian and Smyrna Railways, a company has lately been formed with a capital of T£500,000 to establish electricity generating stations, sugar works, and tanneries in the district.

Cromer.—Price Increase.—The Council has agreed to an application by Messrs. Edmundsons to increase the charge for electricity for lighting from 2½d. to 4d. per unit.

Harrogate.—The Ministry of Munitions and the secretary of the Municipal Electrical Association having informed the Corporation of the intention of the Government to stop further extensions of electricity supply except for munitions and national purposes, the Lighting Committee has decided to protest against what it regards as arbitrary interference with the conduct of local electricity supply.

Lewes.—Electric Pumping.—The T.C. has decided to install an electric motor at the Pinwell pumping station, at a cost of £80.

London.—Marylebone.—The working of the Council's electricity department for the September quarter shows that 2,873,308 units were sold, a net increase of 127,827 units, or at the rate of 4·65 per cent. over September, 1916. The revenue from consumers, including meter rentals, amounted to £29,588, an increase of £1,275. The generation costs show a decrease of 1·3 per cent. Distribution expenses per unit have dropped from ·171d. to ·165d., or practically down to the 1914 level, in spite of the wages increase. The balance available for capital charges, &c., amounts to £14,539, as compared with £14,405 for the September quarter,

1916. For the half-year to September 30th the available balance is £32,061, as against £32,350 for the half-year to September, 1916, a reduction of £289. As the capital charges are estimated to be £1,400 less than last year, the position is considered very satisfactory, though increases in expenditure are inevitable in later statements. At the same time, there has been an increase in sales during the past few months.

Southwark.—Annual Report.—The accounts of the electric light undertaking for the year ending March 31st, 1917, show a net loss of £8,361, chiefly accounted for by the increase in cost of coal and other commodities, &c., restricted lighting, daylight saving and the earlier closing of shops. The loss for the year shows an increase over the previous year of £1,983. The number of units sold shows a decrease of 135,647, or 5 per cent. on last year's figures, but the income from the private supply (lighting and power) improved owing to the advance in price, the increase being £3,291 ; public lighting fell to £1,207 from £3,619 in 1913, and after deducting £586 for maintenance, there was left £620 as revenue from public lighting, barely sufficient to cover capital and stand-by charges on this supply. Sales and repairs to consumers' apparatus fell from £1,115 to £865. Prices had already been raised, and all consumers would come under the coal clause as from the 1st prox., except those on the lighting sliding scale, and these would be included at the commencement of the next financial year. The Newington Electric Lighting Order provided that any deficiency of income in any one year was required to be charged upon, and payable out of, the local rate, and provision had been provided in the current year's estimates to meet an estimated deficit of £8,000.

Stepney.—The B. of T. has notified its approval of the agreement entered into between the B.C. and the Bethnal Green B.C., *re* hiring and maintenance of electric motors, fittings, and apparatus to consumers in the borough of Bethnal Green. The Electricity Committee recommends the purchase of an apparatus for filtering oil from the high-tension switch tanks and turbines at a cost of £157. The Committee also recommends the Council to dispose of the stock of arc lamps and fittings now in store, as it is highly improbable they will be reinstated in view of the use of the half-watt lamp.

The Finance Committee recommends the Council to make application to the L.C.C. for a loan of £4,153, at 5½ per cent., for the purposes of the electricity supply undertaking.

Hammersmith.—The Electricity Committee reports a net profit of approximately £2.500 on the past year's working (to March, 31st, 1917) of the electricity undertaking. The Committee recommends that, owing to the increased risk of damage by fire, the insurance on the buildings at the electricity works be increased to £125,000.

Manchester.—Wages.—At last week's meeting of the T.C., Mr. W. T. Dagnall, chairman of the Electricity Committee, asked the town clerk whether the latest award of the Committee on Production would apply to the workers in the electricity department. Lately there had been several awards, and he did not know under which one they would have to pay. They would certainly have to hand out more money to the workmen, and, as a result, there would certainly have to be another increase in electricity charges.

The town clerk, in reply, held that though there was a doubt as to whether the electrical workers were included in the recent award, he advised that they should recognise the award.

Market Drayton.—Public Lighting.—The U.D.C. has accepted an offer from the Electricity Co. to take £65 in settlement of its account of £100 in respect of public lighting up to the end of 1917.

Newcastle-on-Tyne.—At a meeting of the Newcastle-on-Tyne and Gateshead Chamber of Commerce on the 9th inst., Mr. H. W. Clothier presented a report of a Committee which had been sent to the B. of T. regarding the question of electric power supply in Northumberland and Durham. The report stated that the Committee had taken evidence from 41 consumers, large and small, in the two counties. "The evidence given by these witnesses is unanimously to the effect that they are entirely satisfied with the supply of electricity for their various purposes provided by the electricity supply undertakings of this district. These witnesses stated that they had no complaints whatever to make, and that they were met by the supply undertakings in every possible manner as regards their requirements. The use of electricity has enabled them to effect economy, owing to the low cost of current and the adaptability of its use, thus making further industrial developments possible. The Committee has noted the restrictions imposed by legislation in the past, particularly in the Electric Lighting Acts of 1882 and 1888, and the Power Acts of 1900 and onwards, which have had the effect of restricting the development and prejudicing the supply of cheap electrical energy. The Committee considers that such restrictive legislation should be amended. The Committee is strongly of opinion that in any future legislation which may prove necessary in other districts, much could be gained by a study of the existing conditions in Northumberland and Durham, where the fullest advantage is taken of the resources available. It is also of opinion that in no case should future legislation prevent the making of any mutual arrangement between consumer and supplier which may appear to both to be a commercial proposition." The report was confirmed.

New Zealand.—The Wellington Electric Tramways and Lighting Department's annual report shows that tramway receipts for last year amounted to £207,916, compared with £197,964 in the previous year ; working expenses were £145,385, against £118,817 ; capital charges were £43,601, against £41,927 ; and the net surplus was £18,960, against £27,120. The expenditure on new works last year was £41,571. The total capital expenditure to March 31st last was—on tramways, £752,455 ; power supply, £34,721 ; lighting, £12,182. Receipts from power supply during the year totalled £15,540, compared with £12,763 in the previous year, and the net surplus was £1,729, against £1,306. The passengers carried by the tramway show a daily average of 88.235. The difficulties in obtaining materials hampers construction of rolling stock to meet the demands of traffic.

A Bill has been submitted to the House of Representatives, called the "State Supply of Electrical Energy Bill," to define how accounts in connection with the sale of electrical energy are to be kept. The Bill provides for depreciation, sinking, and reserve funds. The depreciation fund is to be established by annual appropriations of not less than 2 per cent. of the capital cost of the completed works, but the fund is not to exceed one-eighth of the capital cost. Payments at the rate of 1 per cent. are to be made into each sinking fund, but the fund is not to exceed the amount of surplus profits derived from the scheme ; any balance of profits is to be credited to the reserve fund.—*Auckland Weekly News.*

Nottingham.—Proposed Loan.—Last week the City Council had before it a report from the Electricity Committee recommending the Council to apply for the consent of the L.G.B. to the borrowing of £20,000 for the extension of the electrical plant. The Committee states that the demand for the extension arose in consequence of an application for a supply of electricity to a factory at Basford doing national work. Subject to consent, the City Council has agreed to install plant at the St. Ann's Well Road Station, and to lay the necessary cables to enable it to give the supply in bulk.

Portrush.—E.L. Proposal.—At the weekly meeting of the Council, the desirability of introducing electric light was discussed. The clerk said that the loan for doing so could be easily got, as the person who had previously promised the loan had plenty of money.

Rawdon.—The U.D.C., last week, supported the opposition of a considerable number of Yorkshire local authorities to the Yorks. Electric Power Co.'s Bill in Parliament, on the ground that its powers would grant an unfair monopoly to the company.

Salford.—A breakdown occurred on Thursday morning, last week, at the Corporation electricity works, as a result of which the main supply was cut off for half-an-hour. The tramways were held up, and the works where current is used for power were stopped, considerable inconvenience being caused.

At a meeting of the T.C. it was announced that the Electricity Committee proposed to give £156 to the local Red Cross Hospitals, instead of allowing them a free supply of electricity. It was expected that this plan would result in a saving to the rates.

South Crosland.—The U.D.C. has under consideration the proposal of the Yorkshire Electric Power Co. to apply for Parliamentary powers to include the township of South Crosland in the area to be supplied.

Spenborough.—Plant Extensions.—At a meeting of the Council, it was reported that the Ministry of Munitions had recommended the L.G.B. to grant the Council's application for sanction to borrow £8,217 for electricity extensions, and that a local inquiry was not considered necessary. Sanctions had been issued for £3,999 for buildings, repayable in 30 years ; £3,888 for rotary converter and switchgear, repayable in 15 years ; £160 for cables, repayable in 25 years ; and £115 for meters, &c., repayable in 10 years. The Council is having a detailed statement prepared of income and expenditure, with a view to a general revision of existing electricity charges.

St. Anne's-on-Sea.—Mr. Clothier, electrical engineer to the U.D.C., reports that the crankshaft of another of the engines broke recently, thus putting two engines out of commission. With the remaining engines it was impossible to get the full supply, and the street lighting had been curtailed in consequence, whilst the Tramway Co. had to obtain its afternoon and evening supply from Blackpool. There had been considerable difficulty in maintaining a sufficient steam supply. It has been decided to confer with the L.G.B. and the Ministry of Munitions as to the provision of an additional boiler.

Stourport.—The U.D.C. has referred to a Committee the question of opposing the Shropshire, Worcestershire, and Staffordshire Electrical Power Bill, with the object of protecting the interests of the town.

Swansea.—At the last meeting of the Electricity Committee reference was made to the electric lighting recently installed in the houses on Trewyddfa Common. Councillor Richards referred to the fact that when the installation of electric light in these houses was first suggested some doubt was expressed as to the advisability of that course. Events had proved that there had been no necessity for those fears, and the occupiers of the houses were in every way satisfied, and were thinking of having electric cooking and heating installed.

Walsall.—An agreement is to be entered into with the West Bromwich Spring Co. for a supply, at an estimated capital cost of £270. A 200-K.V.A. transformer is to be purchased, at an estimated cost of £250.

Warminster.—The time for making the transfer authorised in the Electric Light Order of 1914 is extended to January 30th, 1919.

Waterford.—The Corporation has agreed that £300, on account of his claim of £886, be paid, without prejudice, to Mr. E. M. Lacey in respect of services in connection with the city electric lighting scheme.

Watford.—Proposed Loan.—Sanction to a loan of £17,800 for additional plant is to be applied for by the U.D.C.

West Hartlepool.—Linking-up.—Inquiries for power having been received from large local consumers, the Electricity Sub-Committee recommends that negotiations be proceeded with for linking-up with the Cleveland and Durham Electric Power Co.'s system, or in the alternative that extensions be made at the Seaton station. Previous negotiations with the Power Co. fell through: at the present time the Council is forced to use the plant at the old station, which is not modern.

Weymouth.—Price Increase.—The B.C. has increased the charge for electricity by ¼d. per unit.

Owing to difficulties, it has been decided to shut down the destructor.

Yorkshire (West Riding).—The West Riding County Council is to obtain the views of the West Riding District Councils' Association, and of the Municipal Borough Councils in the area, on the Yorkshire Electric Power Co.'s Parliamentary Bill. The West Riding Council appears to regard the Bill as giving the company an undesirable monopoly.

TRAMWAY AND RAILWAY NOTES.

Australia.—The Queensland Government has introduced a Bill to provide for the purchase of the authorised tramways in Brisbane and South Brisbane: the franchise of the Brisbane Tramways Co. expires in September, 1920. The proposal is that the Government would issue debentures at 4½ per cent., redeemable in 21 years.

Burnley.—The Tramways Committee has been approached by the local branch of the Amalgamated Association of Tramway and Vehicle Workers, with a view to the formation of a Joint Board on the lines of the Whitley Report. The Committee is favourably disposed to the proposal, and has invited the Association to submit details of the scheme.

Canada.—The British Columbia Electric Railway has received particulars by cable that the Fraser Valley district has been visited by a severe blizzard followed by heavy rains. This caused a coating of ice to form on all telegraph, telephone, light, power, and trolley wires, about 3 in. in diameter, and resulted in the collapse for great distances of the lines and poles. The district was covered by 6 in. of solid ice when the extreme moderation of the weather caused a sudden thaw, which resulted in the overflow of rivers and the flooding of all low-lying country. The company is as yet unable to state the cost of repairs, but it will probably be about $100,000.—*Financial Times.*

Continental.—Spain.—Application has lately been made for a concession for the construction and working of an electric tramway between Tarragona and Valls.

Dronfield.—The Derbyshire County Council has formally refused consent to the Bill of the Sheffield T.C. to construct tramways to Dronfield.

Keighley.—Railless Traction.—The Corporation railless traction service is in difficulties in regard to getting repairs executed. Of the 10 cars in the service only two are now in commission at present, which means that the recent one-car service on each of the three routes is reduced to a one-car service on two routes and no cars on the Oakworth route. The motors, enclosed in the rear wheels, are said to be the cause of the trouble, and, had they not been interchangeable, the service would have been in worse straits before now.

Lancashire and Cheshire.—Wages.—The various tramway authorities in Lancashire and Cheshire have received official application from the Employés' Union, asking for a further war wage advance of 10s. per week for male members and 13s. per week for female employés over 18 years of age. At present the men are receiving 12s. a week advance and the women 9s., and if the new application is granted all employés over 18 years of age will receive 22s. over pre-war wages. For those under 18 an advance of 11s. is asked. Accompanying the application was a 21 days' notice to cease work, unlese the demand is granted, or the case referred to arbitration by the Committee on Production. The latter course has been adopted.

Leeds.—The sudden snowstorm on Tuesday evening, last week, held up the city tramway service for a considerable period, particularly in the out-districts. A long string of cars was held up in Briggate and Boar Lane for half an hour. The special snow plough cars and cars with revolving brushes had to be brought out, and it was not until about 1 a.m. that the whole system was cleared and the last car got back to the depôt.

London.—An agreement has been come to between the London United Tramways Co. and the L.C.C., for the purchase by the latter of the company's undertaking in Hammersmith, at a cost of £235,000, in satisfaction of all items included in the Arbitrator's award of February 12th, 1912. The money is to be paid on or before the expiration of a year from the termination of the war, and the company until then retains the tramways and receipts.

Morecambe.—Proposed Electric 'Buses.—The T.C., considering an overhead electric tramway system to be too costly, has decided, with the permission of a ratepayers' meeting, to promote a Bill for the adoption of electric 'buses to run in conjunction with the old horse cars, so that the public can have the choice of vehicles. The Bill asks for £28,000, but it is only expected to spend about £3,000 at first, having two cars as a trial on the town's sea front. For future purposes the Bill covers all the surrounding district—Heysham, Carnforth, Lancaster rural area, and a number of places in Lunesdale. There has been some little opposition to the Bill on the part of the local motor char-a-banc owners.

Southend-on-Sea.—Electric Vehicles.—The electrical engineer is to report upon the question of obtaining electric wagons for use in connection with the cartage of coal to the electricity works.

Messrs. Ransomes, Sims & Jefferies recently informed the Council that it would be necessary to increase their quotation for electric dust vans: it was mentioned in Council that the L.G.B. had refused to sanction a loan of £4,150 for these vehicles, on the ground that circumstances were not sufficient to justify it at present.

Swansea.—The T.C. has applied to the B. of T. for an extension of time to August 28th, 1919, for the completion of three systems under the Light Railways Extensions Order, 1914.

The engineer has reported that the delays in the tramway service are not due to the Corporation power-station plant, but to the defective overhead system and cars of the Tramway Co. The latter is unable to obtain materials and labour to cope with maintenance and repairs.

TELEGRAPH AND TELEPHONE NOTES.

A Motor-Cycle Wireless Telephone Outfit.—News comes to hand from the United States that an entirely new form of motor-cycle wireless telephone outfit, the invention in part of Capt. F. E. Evans, of the Corps now in charge of recruiting in New York, is at present being tested by the U.S. Marine Corps. It is stated that the generator forms an integral part of the motor-cycle, and that when it is desired to communicate with an aeroplane or field wireless telephone station, all that is necessary is to lower a frame, which raises the rear wheel of the machine clear of the ground, and then move a lever, which connects the engine to the generator through the medium of a worm drive. The outfit, including the aerial, which is of fine steel, and jointed like some fishing rods, is stated not to exceed a weight of 12 lb. complete, and, it is added, that it can handle messages over a distance of from 50 to 100 miles. Tests made with the outfit are said to have proved that skilled men can have the entire apparatus connected up and ready to receive messages in from 1½ to 2½ minutes.

Argentina.—The wireless station erected by the Ministry of Marine at San Julian was opened to public service in October last year; it has a range of 500 km., thus considerably reducing the time for transmitting messages between the extreme south of the continent and Buenos Ayres. When the station at Punta Delgada is completed, the whole coast of Patagonia will be placed in wireless communication.

Broken Insulators.—During the hearing of a case at Lytham, last week, it was stated that in 1916 3,600 telegraph insulators on main lines in the Preston section were broken, costing £577 for repairs. Last year, in consequence of prosecutions, the number dropped to 1,500.

Great Western Railway.—During the past year a total length of 3⅝ miles of air-space telegraph cable was laid by the signal department of the Great Western Railway, as against 5½ miles in 1916. The number of accumulators recharged for working track circuits, electric signals, &c., increased during the same period from 45,000 to 53,000.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

February 2nd. Waterworks department. Electrically-driven radial arm crane. See "Official Notices" January 4th.

Adelaide.—Febuary 27th. P.M.G.'s Department. Telephone material. Schedules 479 and 483. See "Official Notices" to-day.

Manchester.—January 22nd. Corporation Tramways. Block tin. J. M. McElroy, Manager.

Spain.—January 29th. Municipal authorities of Zamora. Concession for the electric lighting of the town; no definite period mentioned. Tenders have lately been invited for the concessions for the electric lighting of the towns of Villaraite and Posada (both in the Province of Cordoba), the concession in the first case being for ten years and in the second for three years.

CLOSED.

London.—Stepney.—Electricity Committee. Accepted tender. E. Foster & Co. 1,200 tons of Snibston nutty slack, at 23s. 2d. per ton.

Hammersmith.—The Electricity Committee recommends that the existing contracts for the supply of coal be renewed where the prices can be arranged without increasing the cost under the controlled prices at present fixed.

New Zealand.—Wellington.—The Public Service Tender Board has accepted the following tender for 30,000 dry cells for telephones: Messrs. Ellis & Co., Ltd., £1,859.—*New Zealand Shipping and Commerce*

Dunedin.—Electric lighting of new cathedral, £1,055, Messrs. Turnbull & Jones, Ltd.

Salford.—Electricity Committee. Accepted tender. British Westinghouse Co., Ltd. Plant required in connection with the supply of electrical energy at Messrs. J. Mandleberg's new works, one 300-k.v.a. transformer, £350, and one e.h.t. switch cubicle, £265.

Walsall.—The Town Council has renewed its contract with Callender's Cable Co., Ltd., for the supply of rubber-covered cable. The following quotations have been accepted by the Council for the purchase from the Council of plant:—

Levenstein, Ltd.—Babcock boiler, Weir pump and two coal elevators, £3,050.
Ellerbeck Collieries, Ltd.—1,000-kw. generating set and spare parts for turbo-generating sets, £670.
Clay Cross Co., Ltd.—Harris-Anderson purifier, £230.
John Shannon & Son, Ltd.—Weir feed pump, £100.

Wolverhampton.—T.C. Accepted tenders:—

General Electric Co.—Converter plant, £2,792.
Brush Electrical Engineering Co.—Two 300-k.v.a. oil cooling transformers, £326.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, January 18th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Papers on "Traction on Bad Roads or Land," by Mr. L. A. Legros, and "Utility of Motor Tractors for Tillage Purposes," by Mr. A. Amos.

Junior Institution of Engineers.—Friday, January 18th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Power Plants, Maintenance, and Advantages of Steady Running," by Mr. R. Rankin.

Salford Technical and Engineering Association.—Saturday, January 19th. At 7 p.m. At the Royal Technical Institute. Presidential address and musical social evening.

Royal Society of Arts.—Monday, January 21st. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "High Temperature Processes and Products," by Mr. C. R. Darling. (Lecture I.)

, Wednesday, January 23rd. At 4.30 p.m. Paper on "Water Power in Great Britain (with special reference to Scotland): its Amount and Economic Value," by Mr. A. Newlands.

Institution of Post Office Electrical Engineers (London Centre).—Tuesday, January 22nd. At 4 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "The Metric System for the Empire," by Mr. A. J. Stubbs.

Institution of Civil Engineers.—Tuesday, January 22nd. At 5.30 p.m. At Gt. George Street, S.W. Papers on "Rail Creep," by Mr. F. Reeves, and "Creep of Rails," by Mr. H. P. Miles.

Institution of Electrical Engineers.—Thursday, January 24th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. 1. Paper on "Telephone Exchange Transfers and their Organisation," by Mr. F. G. C. Baldwin.

(**Students Section**).—Tuesday, January 22nd. At 7 p.m. At Finsbury Technical College, Leonard Street. Paper on "The Evolution of the Thermionic Valve," by Mr. L. R. Smith-Rose.

Greenock Electrical Society.—Thursday, January 24th. At 7.45 p.m. At 22, West Stewart Street. Paper on "Direct-Current Machine Faults," by Mr. J. A. Kinnaird.

Physical Society of London.—Friday, January 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary scientific meeting.

Royal Institution of Great Britain.—Saturday, January 26th. At 3 p.m. At Albemarle Street, Piccadilly, W. Paper on "The Chemical Action of Light" (Lecture II), by Prof. W. J. Pope, F.R.S.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the Electrical Review will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Foreign Trade.—The December Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

		December, 1917.	*Inc. or dec.*	*12 months,* 1917. *Inc. or dec.*
Imports.				
Electrical goods	...	99,542	− 93,214	− 318,134
Machinery ...	...	690,389	+ 169,728	+ 875,274
Exports.				
Electrical goods	...	187,785	− 50,010	− 1,131,326
Machinery ...	...	1,219,694	− 435,335	− 791,291

Languages and Business.—In an address delivered before the Modern Language Association, M. Cambon, the French Ambassador, emphasised the necessity for modern languages as part of the equipment of the business man in the coming days. Such knowledge would be more essential than ever in future, because there would have to be much travelling in order that we might energetically and enterprisingly recuperate a war-devastated world. Such travelling was essential in seeking new outlets, and in consolidating useful relationships.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers, late County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Officer for the Week.—Lieut. P. Bowden.
Next for Duty.—Second Lieut. F. Gaywood.

Monday, January 21st.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 22nd.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.0.

Wednesday, January 23rd.—No. 1 Company, Entrenching, &c., 6.30. Recruits' Drill, 6.30.

Thursday, January 24th.—No. 2 Company, Entrenching, &c., 6.0 Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, January 25th.—Musketry, 5.30—8.0.

Saturday, January 26th.—Musketry, 2.45—4.45. Knotting, &c., for the whole corps, 2.45—4.45.

Sunday, January 27th.—Commandant's Parade at Waterloo Station, 8.45, opposite No 10 Platform. Uniform, haversacks, water-bottles and mugs. Mid-day rations to be carried.

(By order) **Macleod Yearsley**, *Capt. and Adjutant.*

The Wages of Electrical Employes.—The meetings and discussions which have been held during the past four months with regard to the wages of electrical workers have at last resulted in the issue of a definite award by Sir George Askwith, the Chief Industrial Commissioner; and although some minor questions still await settlement, the principal problems have been solved in accordance with the invariable practice of the Government in war time—namely, by acceding to all the demands that are made upon it. The following are the main features of the negotiations, which have been touched upon from time to time in our columns:—The first conference was held on September 6th, with Sir George Askwith in the chair, to consider the claims of the Electrical Trades Union and the National Union of General Workers, and the Association of Municipal Electrical Engineers of Greater London undertook to ascertain the views of the Borough Councils and other municipal authorities that owned electricity undertakings in the metropolitan area. In the meantime, Sir George Askwith suggested that the awards of the Committee on Production, amounting to 15s. advance on pre-war rates, should be extended to the electrical members of the staffs of electricity supply undertakings, as from September 1st. The Conference of Local Authorities met on October 22nd and appointed an Executive Council, which agreed to recommend the adoption of the 15s. award, and this decision was confirmed by the Conference on November 6th, taking effect as from September 1st. But the Trade Unions were out for the additional 5s. award of the Committee on Production and the 12½ per cent. award of the Ministry of Munitions also, and the Executive Committee proceeded to consider these demands. On January 1st a meeting took place between the Committee and representatives of the Electrical Trades Union, the National Union of General Workers, and the National Amalgamated Union of Enginemen, &c., and Electrical Workers, at which the Committee decided to recommend the payment of the additional 5s. as from the first full pay week in December, making the full advance on pre-war rates £1; it was also decided to agree to any further advance awarded by the Government to the engineering and foundry trades, but the question of the 12½ per cent. award was held over.

On January 8th the Electrical Trades Union decided to resort to a strike, in order to enforce their demands by shutting down the generating stations, but were induced to return to work by an assurance that the 12½ per cent. dispute would be settled immediately, and on Monday, January 7th, a Conference was held, under the presidency of Sir George Askwith, to fulfil this undertaking. The Greater London electricity supply undertakings, railways, tramways, and contractors were represented at the meeting, with delegates from the Electrical Trades Union: other Trade Union delegates also attended, but the Electrical Trades Union objected to their presence at the meeting, and apparently succeeded in carrying the point. The Union claimed the 12½ per cent. for all the sections included in their trade card, while the employers' representatives pointed out that they could not deal with this matter owing to the uncertainty as to the classes covered by the award; the latter also urged that, in view of the increases in wages, which seriously affected the costs of electricity supply, the Government should take steps to enable the maximum price to be increased beyond 8d. per unit, and to authorise the revision of contracts with consumers to meet the extra costs.

As reported in our last issue, the Conference lasted for no less than eight hours, and eventuated in the award of Sir George Askwith which we published on page 41 of our last issue. The award relates mainly to the 12½ per cent. bonus, the only specific point which was brought before Sir George Askwith, as the London municipal supply authorities had already practically agreed to pay the 20s. advance, as well as a large number of undertakings in the Provinces; but the corollary to the award—namely, that authority would be given to raise the maximum price for electrical energy, and to revise existing contracts, the necessity for which action arises out of the back dating of the Commissioner's decision to October 13th—was not announced last week.

In an explanatory letter Sir George Askwith refers to questions relating to the interpretation of the award, and states that the decision is of a general character, and is intended to apply to all employés working on plain time in generating and sub-stations, and on mains, or otherwise directly concerned in the generation and distribution of electrical energy, including the technical staffs, throughout the country; it is impracticable to decide in detail how the decision is to be applied to each individual undertaking—each must construe it in a reasonable manner depending on the circumstances, and decide to which members of the technical staff the award should apply. Thus the question which has divided the staffs for so long still remains unsolved—namely, where the line of demarcation between the technical man and the tradesman should be drawn—and a new bone of contention is introduced, for the question arises at once to what rank of the technical staff the award shall extend. As we understand the terms of the award, its upward scope is not explicitly limited; in fact, even the chief engineer of any electricity supply undertaking, no matter how large his salary, could apparently demand and obtain an addition of £1 a week and 12½ per cent. on his salary, as a member of the technical staff; it is, however, absolutely unthinkable, to our mind, that the chief engineer of any important undertaking would take advantage of such an opportunity to enrich himself under existing circumstances, seeing that by so doing he would not only deliver himself bound and gagged into the hands of the Trade Unions which have secured the advance, and of which he ought therefore, in common honesty, to become a member, but would also lay himself open to a reasonable charge of profiteering. The burden of the war should be shared by all classes alike, and those who are already in receipt of salaries sufficient to meet their needs have no right to demand from the community any additional payment.

Another point which arises out of the award is the question whether the men employed, for example, as charge engineers, stokers, &c., in public institutions, such as workhouses, asylums, &c., or in privately-owned factories, in the generation and distribution of electricity are entitled to share in the advance. The award is so wide that we believe they are so entitled, but it will be necessary for them to claim the advance from their employers in the first instance, and if it is withheld, to demand a reference to the arbitration of the Commissioner, as individual cases cannot be adjudicated until an actual difference of opinion has arisen.

As the employés of electrical contractors on munition work are included in the award, which is back-dated to October, it will be seen that contracts carried out and paid for during the past three months will have to be revised, and the purchasers will be called upon to pay the extra cost of labour in such cases.

As for the general aspect of the award, which has been the cause of so much disturbance and unrest, we may point out that it was due to the action of Mr. Churchill, the Minister of Munitions, who, apparently without consulting the Committee of Production which was appointed expressly to handle the question of wages, and has admirably fulfilled its duties, arbitrarily and unwisely gave the 12½ per cent. bonus to certain sections of engineering workers, in ignorance of the existing conditions, with the inevitable result that all other sections of the industry naturally demanded a corresponding increase, and the last state is worse than the first. For thus rushing into a most complex and delicate situation he has been severely taken to task by his colleague, Mr. G. N. Barnes, who, pointing out the disastrous consequences of such a policy, which tends to promote slackness amongst time-workers and to discourage piece-workers, at a time when the maximum output is required, deprecated strikes on the part of men who were earning good wages. Undoubtedly to strike at this time, the crisis of the war, is an unpardonable crime against one's country; the striker is an ally of the Hun, and will, as Sir Auckland Geddes says, deserve the hatred and contempt of his fellow-countrymen.

Clyde Engineers.—The threatened trouble in the Clyde engineering trade over the 12½ per cent. bonus, which is regarded as unsatisfactory by the men, was the subject of a further conference at the Ministry of Munitions on Saturday with representatives of the trades concerned. Objection is taken by the men that the original offer of 6s. 9d. a week made by the Employers' Association, which had in many cases been accepted, is now superseded by the 12½ per cent. bonus. They urged that the 6s. 9d. should be endorsed by the Government if further trouble is to be averted.

The Minister of Labour telegraphed that he had decided to adopt the recommendations of the Trade Union Advisory Committee for the Shipbuilding and Engineering Industry as a basis for the settlement of all outstanding claims arising from the 12½ per cent. order. All applications should be made through the Trade Union Executive, who were the regular normal channels of communication between the Trade Unions and the Ministry of Labour. No application would be referred for settlement so long as a stoppage of work continued.

Mr. G. N. Barnes, M.P., addressed a crowded gathering at Glasgow, on Sunday. He said that during the last few months they had been living on a veritable industrial volcano, expecting day by day to be blown up. The 12½ per cent. had become an obsession on the part of many men in the shipbuilding yards, engineering shops, and other places. These men he placed alongside the profiteers. Every time they struck for higher wages other people were worsened. Those who struck were the comparatively more highly-paid, earning £4 or £5 a week, and every time they struck the currency was diluted, and the prices of goods rose sympathetically, so that the great masses of the poor, including the families of soldiers, had harder lives, and had to bear more than their fair share of the war.—*Daily Telegraph.*

Last Saturday, the Clyde District Committees of the Societies affiliated to the Engineering and Shipbuilding Federation adopted a resolution instructing their Executive Council to call upon the Government to withdraw the new Man-Power Bill before the end of January. Failing this they would ask their Clyde members to down tools. They further asked the Government to call an International Conference to discuss the question of peace.

New Type of Enclosed Motor.—With reference to our article on this subject on page 31 of last week's issue, the address of the Enclosed Motor Co., Ltd., who are the owners of the patents, &c., is Finsbury Court, Finsbury Pavement, E.C. 2.

Cooking Appliances.—A course of three lectures on "The Principles of Fuel Economy in the Design and Use of Cooking Appliances" will be delivered at University College, London, by Mr. A. H. Barker, B.A., B.Sc., on Wednesdays, January 23rd and 30th, and February 6th, at 7 p.m. The lectures are open to the public without fee or ticket. Further particulars may be obtained on application (accompanied by a stamped addressed envelope) to the Secretary, University College, London, Gower Street, W.C. 1.

Institution and Lecture Notes.—Institution of Civil Engineers.—The Council has resolved that its examination in Engineering Drawing, Bills of Quantities, and Elementary Knowledge of Specifications, which is at present an optional subject, shall be after January 1st, 1919, obligatory for all candidates for Associate Membership.

Association of Mining Electrical Engineers.—At a joint meeting of the West of Scotland Branch of the Association and the National Association of Colliery Managers, at Glasgow, on Saturday, a paper was read by Mr. J. H. C. Brooking, on "Cable Complaints."

Birmingham Electric Club.—Mr. J. J. Richardson delivered his presidential address on Saturday last, dealing with the history of electricity and electric lighting.

Appointments Vacant.—Teacher in electrical subjects for classes for training disabled soldiers (£4) for the Croydon Education Committee; switchboard attendant (56s. 3d.) for the Walthamstow electricity and tramways department; junior shift engineer (45s. +) for the Borough of Warrington electricity department; assistant shift engineer (70s.), also switchboard attendant (63s.), for the Borough of Pattersea electricity works; switchboard attendant for the Derby Borough electricity works; meter tester (45s. +) for the Borough of Rochdale electricity department. See our advertisement pages to-day.

Welfare Work at Fullers' Works.—We have received some reports from this firm which show that while the new works are being energetically carried on, the social welfare of the workers is not overlooked; the reports relate to canteen work, allotments scheme, first aid, and the War Saving Fund. We notice that an efficient and handsome canteen will shortly be erected; but what is especially interesting is the fact that a canteen providing light but nourishing refreshments has now been successfully carried on for 10 months without loss, and at the same time has been entirely self-supporting. This fact is useful knowledge for any manufacturer who desires to help his employés without incurring the responsibility of an expensively equipped canteen. The other reports on allotments, first aid, and War Saving Fund are equally interesting and instructive, showing what satisfactory results can be attained by co-operative effort.

National Insurance (Part II) (Munition Workers) Act, 1916.—The following are further decisions of the Umpire. Contributions are payable in respect of:—

2,407 X. Workmen described as valvemen, hydaulic main men, tar main men, and exhauster men engaged wholly or mainly in connection with the operation of by-product plant attached to coke ovens.

2,408 X. Workmen engaged wholly or mainly in the manufacture from rubber or rubber-proofed fabric of gas bags for motor-cars. (Application 502.)

A 2,410 X. Students at technical institutes receiving training under arrangements made by the Ministry of Munitions in any of the trades set out in the Sixth Schedule to the National Insurance Act, 1911.

A 2,411 X. Students at technical institutes receiving training under arrangements made by the Ministry of Munitions in any of the trades set out in the First Schedule to the National Insurance (Part II) (Munition Workers) Act, 1916, or in munitions work.

Electrolytic Production of Zinc in Tasmania.—The *Times* says that satisfactory results are reported from the plant erected at Risden, Tasmania, for the electrolytic production of zinc from Australian ore and concentrates. The plant has a daily capacity of 15 tons, which it is said can be increased tenfold, and the necessary electric power is obtained from the State's Great Bear hydro-electric installation.

The Electrical Trades Benevolent Fund: the Special Appeal.—We have received from the secretary of the E.T.B.I. the following list of contributions received as a result of the special appeal which was made with a view to bringing the invested fund of the organisation up to £10,000. Nearly £200 more is still required, and we trust that further special contributions will be received by Mr. Hawes in the course of the next week or two, so that the trustees can be placed in the position desired:—

Salomons, Sir David..	£20	0	0
Vickers, Ltd.	21	0	0
Holmes, J. H.	5	0	0
Tufnell Carlton, F.	3	3	0
Hooper, John P.	10	10	0
Marryat, H.	5	6	0
Christopherson, Clifford & Co.	5	5	0
Hecht, Levis & Kahn	2	2	0
Heilbut, Symons & Co.	10	0	0
Aldens Successors, Ltd.	10	0	0
Frederick Smith & Co.	2	2	0
Callender's Cable and Construction Co.	21	0	0
	£115	7	0

Joint Boxes and Terminals for Split Conductor Cables.—With reference to the article under this title in our issue of January 4th, we are informed that the use of braids for cable jointing is covered by Mr. Charles Vernier's Patent No. 15,413/09.

Fatalities.—A newspaper report says that William Joyce, 63, foreman fitter at the Scarborough Electric Supply Works, ascended to the top of a boiler at the works to look at some seeds which he was forcing, when he appears to have tripped and fallen to the ground. He was found, later, lying dead.

An inquest was held at Southport recently on Celia Clarkson, wife of a soldier, who had been employed as driver of an overhead electric travelling crane at the L. & Y. Railway goods depôt. Evidence was given that on May 4th last the deceased told her mother she was oiling the crane when some electricity "shot out," which seemed to roll her up like a ball, causing her to fall from the cage to the stage below, a distance of 15 ft. She was admitted to the infirmary suffering from a fractured spine and paralysis of the arms and legs, was discharged on November 14th as incurable, and died on January 7th. A witness said it seemed to her that the deceased touched a live wire, but the district inspector thought the woman fainted and fell from the cage. A verdict of "Death from misadventure" was returned, the jury expressing the view that greater precautions should be taken.

Electrolytic Zinc in Australia.—The plant established at Risden, Tasmania, has proved the possibility of the application of the electrolytic process to Australian ores and concentrates for the production of zinc for munitions, heretofore produced within the Empire only in small quantities. M. Balillieu, chairman of the Electrolytic Zinc Co., states that the present plant has a capacity of 15 tons daily, which can be increased tenfold. Competition between the technologists of the Risden electrolytic process and the Port Pirie retort furnacing process has already produced metallurgical improvements.

Electric Light Switching Exams.—Many people may feel amusement at the idea of a private firm holding examinations and issuing certificates in this or any other subject, but the President of the I.E.E. is not one of these, as may be seen from a remark in his address; if these exams. had met with a poor response, it might reasonably have been inferred that the subject was one that did not matter, but as—even in such a time as the present—Messrs. Lundberg are able to show such results as those appearing on another page in this issue, it may certainly be concluded that the subject possesses both utility and interest.

We have had the opportunity of inspecting the papers submitted by some of the top men in each grade of the last examination, and have been very much struck by the amount and high quality of the work done by these premier candidates. It is quite evident therefrom that something beyond the securing of a certificate and a possible book prize must have spurred them on to such efforts in such a busy time as the present. Though many of the examinees, judging from the papers we have seen, are used to examinations, it is certain that the subject prompts many workers to express their ideas of circuit diagrams and other matters on paper for the first time, and these switching exams. should undoubtedly encourage hitherto apathetic individuals to consider the advantages of attending classes in "Electrical-installation Work" at technical institutes, and of proceeding in due course to the examination in that important but somewhat neglected subject. So much neglected is it, that there are to be no City Guilds exams. appertaining to it this session, because of the war. The exam. in "Gas Fitting," however, is to proceed as usual!

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Swansea Corporation Finance Committee recommends that the salary of the borough electrical engineer, Mr. W. J. Burr, be advanced by £100 per annum.

The marriage has taken place at Richmond-on-Thames of Lieutenant A. J. James, R.N.V.R., who was on the staff of the Bedford Corporation electricity works, and Miss K. Fowler, of Bedford.

Kendal T.C. has increased the salary of the electricity works manager by £20 to £220 per annum.

Hastings T.C. is increasing the salary of Mr. N. J. Ryan, chief assistant electrical engineer, from £180 to £220 per annum, and by subsequent increments of £10 to £250.

Walsall Town Council has sanctioned the following increases of salary:—Mr. C. W. Cookson, accountant and collector, electric supply department, from £188 to £214 per annum; Mr. John R. Taylor, chief clerk, tramways department, £25 per annum.

Wolverhampton Town Council has appointed Mr. Charles William Charlesworth, of Stoke-on-Trent, commercial secretary to the electricity undertaking at a salary of £300 per annum.

It was mentioned at a meeting of the Kilmarnock Corporation Electric Committee that Mr. Bexon, the engineer, was an applicant for a situation under the Birmingham Corporation at a considerably increased salary. With the view of retaining Mr. Bexon's services it was proposed that he be offered a three years' engagement at a commencing salary of £550 for the first year (being a present increase of £100), to rise £50 at the end of each of the first and second years, making his salary for the third year £650. The Town Council has delayed the matter for a month.

Mr. A. G. Durrant, of the Great Yarmouth Corporation tramways and electricity departments, has been appointed electrical engineer in charge of new electricity works for Messrs. John Chambers, Ltd., shipbuilders and engineers, to supply their No. 3 Shipyard, and also the Oulton Broad Electricity Co., with power and light. The tramways manager, Mr. F. L. Turner, presented Mr. Durrant with a barometer and thermometer, and he received a writing case and wallet from the electricity works mains department.

On Thursday evening last week a big muster of the staff and employés of the Bristol Corporation electricity department assembled at the Lecture Theatre of the Museum to commemorate the 25th year of service of Mr. H. Faraday Proctor as engineer and general manager of the department. The chair was taken by Mr. F. W. Prosser (secretary and sales manager), who was supported by Mr. A. J. Newman (deputy engineer), Mr. Thos. H. Gait (accountant), and Mr. J. Stapleton (foreman of the Feeder Road electricity works). The chairman traced the history of the undertaking from its inception in 1883. The late Sir William Preece (who was appointed consulting engineer) was instructed to provide an equipment for 20,000 30-watt lamps. The equivalent 30-watt lamps installed to-day is 935,000. The "baby" of the Bristol Corporation had been tenderly nursed, and had come to maturity under the parental guidance of Mr. Proctor, who, despite many temptations of more lucrative appointments elsewhere, had succeeded in placing the department in a most enviable position.

Mr. T. H. Gait, on behalf of the accountancy and clerical staff, tendered sincere congratulations, and voiced the pride and satisfaction of the staff in their "chief" and in the electricity department, and remarked that Mr. Proctor held very prominent positions in the electrical world in connection with the I.M.E.A. and the I.E.E. The I.M.E.A. owed its foundation to Mr. Proctor. Mr. Proctor's attitude towards the staff and employés had always been most generous and kind, especially to those members who were serving with the Forces. Mr. J. Stapleton spoke on behalf of the workmen.

Mr. A. J. Newman, in a brief speech, compared the position of the undertaking 25 years ago with its present position, and gave the following details:—Number of consumers: 1893, 120; 1917, 5,800. Staff and employés: 1893, 30; 1917, 230. He said for one man to "skipper" the good ship "B.C.E.D." to its present enviable position was a very meritorious accomplishment. He asked Mr. Proctor to accept a silver epergne and silver cake tray as a slight token of their loyalty and esteem.

Mr. Proctor, in responding, said he really could not find words in which to express his thanks to those who had arranged the social evening, and for the beautiful articles with which they had presented him. He was grateful to all who had come to mark his 25th year of service with the Bristol Corporation. The day was not very far distant when a site would have to be found for the main generating station, as the water in the Feeder Canal and River Avon would be far too little for ultimate developments. If the recommendations of the Coal Conservation Sub-Committee were adopted it would be just possible that a large station would be erected on the banks of the Severn, where chemical and high explosive, together with spelter works, were being contemplated. The Lord Mayor of Bristol in several speeches he had recently made commented on the Labour unrest, and advocated that the heads of all business establishments should take their staff and employés to their hearts. In the early days of this undertaking it was a great pleasure to him to know every employé by name and something about him, but the increasing growth of the department had unfortunately prevented this in the latter years. It was a matter of great regret to him that he could not come into contact with them more often. He was very glad to say that no serious trouble had ever arisen with any portion of the staff or employés, and he thought this was a fact to be justly proud of. There was no reason why there should be any trouble. The Corporation had a duty to fulfil in seeing that the conditions under which their employés worked were satisfactory.

Mr. Chas. Hancock (one of the oldest members of the general office) proposed a vote of thanks to the chairman, coupling with it the ladies of the staff who had contributed to the musical part of the programme. The proceedings closed with the National Anthem.

General.—Mr. H. Barge, engineer at Messrs. Bullivants, Millwall, E., and son of the chairman of the Poplar Electricity Committee, has been appointed Officer of the British Empire.

Mr. G. H. Cutting, of Messrs. Cutting Bros., Ltd., electrical engineers, of Stamford, has been appointed on the Local Advisory Committee formed to co-operate with Labour Exchanges in dealing with demobilisation, the employment of discharged soldiers, and the substitution of men to take the places of men eligible for the Army.

Vice-Admiral Sir Reginald H. S. Bacon, D.S.O., has been appointed by the Minister of Munitions as Controller of the Munitions Inventions Department in succession to Colonel H. E. F. Goold Adams, C.B.

Indian Engineering states that Mr. C. Landon, Superintendent of Telegraphs, on expiry of leave granted him on return from field service in East Africa, has been posted to the charge of the Trichinopoly Division; also that Sir William Maxwell, Director-General, Post and Telegraphs, is at present making a tour of inspection in Mesopotamia in connection with postal and telegraphic administration in that area.

Stepney B.C. Electricity Committee has appointed Ald. Kiley Chairman and Coun. Kosky Vice-Chairman for the ensuing year.

Mr. Tomy Thompson, who is the Swansea district engineer for the British Westinghouse Electric & Manufacturing Co., Ltd., is the author of a novel, entitled "Letters to Lady Shesheen," which has lately been published at 5s. net by Messrs. Murray & Evenden, Ltd., 32, Essex Street, W.C.

Mr. E. S. Lowes, the secretary of the Southern Brazil Electric Co., has been appointed manager of the company in London.

Mr. Frank A. Hammond, of Leeds, who at present holds a position under the Nova Scotia Tramways & Power Co., has contributed to the *Yorkshire Post* a long account of the disastrous explosion which occurred at Halifax in December.

Mr. James N. Wilson, the secretary and treasurer of the Glasgow Corporation tramways undertaking, has been appointed secretary of the Tramways Control Committee appointed by the Board of Trade to supervise the whole of the tramway undertakings of the country.

Mr. W. B. Woodhouse, chief engineer and manager of the Yorkshire Electric Power Co., is to lecture on coal conservation and the national electricity scheme, and Mr. P. J. Pybus, Commander of the Order of the British Empire, managing director of the Phœnix Dynamo Co., Bradford, is to lecture on new ideas of factory management, at the Saturday night "talks" at the Dewsbury Central Liberal Club.

Mr. T. W. Dunning has been appointed Superintendent of Telegraphs at Southampton, in succession to Mr. E. Long.

A New Zealand paper states that Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, will return to the United Kingdom after he has completed three years in the Dominion. He will then spend 12 months touring the United Kingdom in order to bring to British manufacturers the benefit of his special knowledge of the business conditions of the Dominion.

Mr. William Geipel (W. Geipel & Co.) has publicly announced that as from December 10th, 1917, his name is changed to William Guy-Pell.

Mr. J. M. Clark has resigned his position with the Alloa Corporation to take up an appointment with Messrs. Kelsall and Parsons, 227, St. Vincent Street, Glasgow, agents for the Lancashire Dynamo Co., George Ellison, Laminated Gears, Engineering & Arc Lamps, Ltd., &c.

Amongst the naval officers brought to the Admiralty under the new organisation is Captain Nicholson, the head of fleet communication, who was the Wireless Officer of the Grand Fleet, and in that capacity was present at the battle of Jutland.

Roll of Honour.—One of the directors of the Electrical Apparatus Co., Ltd., Captain E. A. Godson, M.C., of the Royal Irish Fusiliers, has recently been mentioned in the dispatches of Sir Douglas Haig. Major W. Roberts, R.F.A., the company's late South Wales representative, has been granted the Military Cross for distinguished service.

Private A. S. Chantry, Machine Gun Corps, who has fallen in action, was engaged in the electrical department of the Rotherham Main Colliery.

Brigadier-General Mance, who was appointed a C.B. in the New Year Military List of Honours, is the son of Sir Henry C. Mance, who has been an eminent member of the electrical profession for so many years.

The *Times* states that Second-Lieutenant A. W. H. Purnell, R.G.A., who was previously reported as missing, died as a prisoner of war at Winkel St. Eloi, in Belgium, on November 20th, from wounds received on November 13th, aged 24. He was educated at Loughborough Grammar School, subsequently entering the State University at Coethen-in-Anhalt, in Germany, for part of his training in mechanical and electrical engineering. There he took his diploma with honours in all subjects. On his return to England he entered the works of Herbert Morris, Ltd., at Loughborough, of which his father is a director, and in October, 1914, joined the Motor Transport Service.

Brigade-Major F. Barritt Hills, R.G.A., who has been awarded the D.S.O., is manager and secretary of the North of Scotland Electric Light & Power Co., Ltd., Montrose.

Amongst the new Members of the Order of the British Empire is Mr. Mathew Adam McLean, shop superintendent of the British Westinghouse Electric & Manufacturing Co., Ltd., Trafford Park.

Mr. Philip E. Parker, of Clitheroe, who has been serving as a wireless operator, is reported by the Marconi Co. to have been drowned at sea.

Amongst the new Members of the Order of the British Empire appears the name of Mr. James Connor, works manager of Messrs. Dick, Kerr & Co., Ltd., Preston.

Private W. Roskell, Royal Sussex Regiment, who has been killed in action, was an apprentice with Messrs. C. T. Briscoe and Son, electrical engineers, Blackburn.

Sapper J. Fuller, R.E., who has been killed in action, was employed by Messrs. J. H. Taylor & Co., electricians, &c., Huddersfield.

Second-Lieutenant G. E. Cashmore, R.F.A., who recently received the Military Cross at the Investiture at Buckingham Palace, was a member of the staff of the Birmingham electric supply department.

Captain Norman Taylor, R.E., who has been awarded the M.C., is the elder son of Mr. F. W. Taylor, head of the firm of F. W. Taylor & Co., electricians, Milnsbridge, with whom he was associated in business prior to November, 1914, the time of being gazetted. He is now in Macedonia.

Sapper W. E. Greetham, R.E., Cable Section, who is reported to have died in hospital whilst in India, was apprenticed to Mr. G. Newby, electrical engineer, Harrogate.

Captain Ford Jones, who has been honoured with the M.C. decoration, was an electrical engineer in Swansea.

Captain J. Steven Hamilton, of the West Yorks. Regiment, second son of Mr. J. B. Hamilton, commercial manager of the City of Leeds, has been promoted to a captaincy, and made the recipient of the D.S.O. for brilliant services rendered with his regiment in a recent engagement. He was an assistant engineer to the Leeds tramways department. Four of his brothers are also serving (one has been posted missing since May 12th last).

Private W. Harwood, Loyal North Lancashire Regiment, killed in action, was on the staff of Messrs. Bullers, Ltd., of Hanley.

Private J. Biddulph, Royal Berkshire Regiment, who was with Messrs. Taylor, Tunnicliffe & Co., of Hanley, reported missing, is a prisoner of war in Germany.

Second-Lieutenant J. E. Davies, King's Liverpool Regiment, who was an engineer at the Rugby works of the B.T.H. Co., has been promoted to the rank of Lieutenant.

Second-Lieutenant J. E. Baskett, R.G.A., who has died of wounds, was at the Rugby works of the B.T.H. Co., Ltd.

Captain M. D. Cloran, R.G.A., holder of the Military Cross, who was on the engineering staff of Messrs. Willans & Robinson, Ltd., Rugby, has been wounded in the thigh, and is in hospital at Manchester.

The death in action is reported of Private W. Roskell, Royal Suffolk Regiment, who was in the employ of Mr. T. Briscoe, electrical engineer, of Blackburn.

Mr. William Nettleship, who has been granted a commission from the ranks as Second-Lieutenant in the R.F.C. (he is to be Mechanical Equipment Officer), was in business as an electrician, &c., in Bridlington.

Corporal J. Barlow, lately in the employ of the Stepney B.C. electricity department, has been awarded the Military Medal.

Major Gordon C. Kennard, R.E., of the Westinghouse Cooper-Hewitt Co., was awarded the Military Cross in the New Year's Honours List, for distinguished conduct in the field.

Private R. C. Whewell (21), Royal Scots Regiment, who is already the possessor of the D.C.M. and Military Medal decorations, has been recommended for further honours. He was employed by the Lancashire Electric Power Co.

Mr. Clarence Scott, of Leeds, leading telegraphist in the Navy, has been drowned at sea.

Corporal A. C. Chambers, who has been killed in action outside Jerusalem, aged 21, after being recommended for the D.C.M., was an apprentice with Messrs. Elliott & Co., electricians, Oxford, when he volunteered for service in 1914.

Second-Lieutenant C. W. Caswell, Middlesex Regiment, who has been awarded the Military Cross, was with Messrs. Barnett & Sons, electricians, Kettering.

Private A. Frost, Royal Fusiliers, previously reported wounded and missing, is now reported killed in action. He was employed at the Chiswick electricity works.

Staff-Captain William Alan Fraser, D.A.Q.M.G., R.E., reported killed in action, for some time filled an appointment as electrical engineer under the Edinburgh City Council, and was later borough electrical engineer at Lancaster and Nelson. While at Lancaster he volunteered for service in the South African war, and served through that campaign with the Middlesex Yeomanry. Before joining up for the present war he held appointments in America. He had been mentioned in dispatches in this campaign, and was promoted to Staff Captain.

CITY NOTES.

British Columbia Electric Railway Co., Ltd. Mr. G. P. Norton presided at the annual meeting last week. He said that the decision to postpone the payment of the interim dividend on the 5 per cent. cum. pref. stock had been made in view of the uncertainty as to the amount of the earnings in the immediate future, and because they could not prudently continue to pay the larger portion of that dividend out of the reserve fund. Since the annual report was issued they had received by cable the statement of income and expenditure for the month of November, showing an increase in gross earnings of $52,862, and in net income of $31,772. Thus the gross earnings for the first five months of the current financial year showed an increase of just under $200,000 over the earnings for the same period of the preceding year, but, unfortunately, the increase in the net income for the five months only amounted to $29,000, or, say, £6,000. They could, however, take some encouragement from these figures, as the increase in gross earnings was due to a very marked improvement in trade and business conditions in British Columbia, which had every indication of being of a permanent character. If, therefore, as a result of the report of the recent commission of inquiry, jitney competition was abolished, and other conditions were fairly adjusted, there was a sound basis on which to build hopes that less difficult times were in store. The policy and prospects of the company were dependent on the result of negotiations now being carried on with the object of bringing about a fair and satisfactory re-arrangement of working conditions, based on the commissioners' report.

County of London Electric Supply Co., Ltd. The *Financial Times* states that the County of London Electric Supply Co. has deposited a Parliamentary Bill seeking certain financial powers. The preamble recites that in 1913 the company was authorised to acquire a site and erect a generating station in Barking, and it was the intention to raise capital for the purchase of the site and the erection of the station, but, owing to the war, it was not, and will not now be, possible for the company to raise the capital on the terms contemplated prior to the war. The preamble further recites that the company is desirous of placing itself in a position to proceed forthwith, on the conclusion of the war, with the erection of the generating station, and with that object to make all necessary arrangements in advance. The Bill, therefore, proposes to empower the company to "pay out of its capital interest at the rate of 5 per cent. per annum upon any shares and debenture stock issued for the purpose of acquiring the generating station site and constructing thereon the works authorised." The aggregate amount to be so paid for interest is not to exceed £150,000, except with the consent of the Board of Trade. The unissued share capital amounts to £300,000, but the Bill provides that the interest paid out of capital is not to operate as a reduction of the amount paid up on the shares or debenture stock, but is to be "charged by the company to capital as part of the costs of construction of its undertaking."

Kaministiquia Power Co.—For the year ended October 31st last the gross revenue was $380,388, operation and maintenance $55,812, depreciation and renewal reserve $34,000, the net revenue being $290,576. Fixed charges amounted to $96,125, leaving a net income of $194,451. Dividends representing 7 per cent. on the paid-up capital, absorbing $153,720, have been disbursed, and $40,731 has been transferred to surplus account. Since the end of the year the company has received orders for power for new grain elevators, which have been erected, as well as for some industrial plants that have been closed down on account of the war, and are now re-opening. There are also prospects of one or more pulp mills being established in the locality, and if these mature the company will doubtless be called upon to supply the electrical power.—*Financial Times.*

Liverpool Overhead Railway Co.—Final dividend, for the half-year ended December 31st last, at the rate of 5 per cent. per annum, less income-tax, on the preference shares, and at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares, making for the year 5 per cent. on the preference, and 3¼ per cent. on the ordinary shares.

General Electric Co., Ltd.—A financial daily states that in addition to the half-yearly dividend of 6s. per share, paid on the preference shares, less income-tax at 5s., on December 31st, an additional distribution was made of 3s. per share, free of income-tax, representing the income-tax deducted in December, 1916, and June, 1917.

Edison & Swan Electric Co., Ltd.—The resolution for reduction of capital was confirmed at an extraordinary meeting held on January 9th.

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in :—

United Electric Car Co., Ltd.—100,000 7 per cent. cumulative preference shares of £1 each, fully-paid (Nos. 1 to 100,000).

Western Union Telegraph Co.—Extra dividend of 1 per cent., in addition to the regular quarterly dividend of 1¼ per cent.

STOCKS AND SHARES.

Tuesday Evening.

Prices in the Stock Exchange are what the financial journalist delights to call well maintained. The scribe likes to write of cheerful things in matters connected with stocks and shares; George Gissing would have made a disastrous City Editor. There is that in human nature which makes for optimism; a bear is the most timid animal in the Stock Exchange menagerie. So it is pleasant to say that markets are good. That electric railway stocks are materially better. That manufacturing shares are firm as ever. That affairs in Mexico do flatter a faint hope of improving conditions That Stock Exchange business might easily be worse than it is.

Three years have elapsed since the markets were allowed to return to their rightful home, after wandering for five months in the draughty trench called Throgmorton Street. By far the majority of electricity investments stand higher now than they did in those early days of 1915. Badly-shaken confidence has been restored. Companies have found unexpected developments for profitable working. There is money available for use even in directions other than those of feminine luxuries. The war marches to its appointed end, premium bonds or no, and the hopeful folk detect slender shafts of blue far off on the horizon of the war-laden skies. Stock Exchange markets are firm and investments on the rise, in spite of the conviction that a 5s. income-tax and an 80 per cent. excess profits duty may be made to appear, by comparison, but easy burdens when the next taxation scales are announced.

The trio of Central London assented stocks, ordinary, preferred and deferred, rose 2 points apiece to 62½ on the stimulus of a modest demand. Metropolitan Consolidated also proved to be in short supply and gained ¼. Districts lag behind, and the Underground Electric group keeps steady. Nothing has been published of the expected scheme for an association to look after the interests of railway stockholders south of the Tweed, on the lines of that formed in Scotland for safeguarding railway interests there.

The Metropolitan Railway will announce its dividend on January 25th, while the declarations of the District, London Electric, Central London, City and South London, and the L.G.O. will be made on February 7th.

Brisbane Electric Tramways ordinary have fallen to about £5, and business has been done in the preference to 3⅞, on the proposed high-handed action of the Queensland Legislature, as outlined here last week. How to object with any degree of success from this side, those who are interested admit that they frankly are unable to see at present, but it will seem a thousand pities if the Queensland Government pays no heed to the protest made against its scheme.

Colonial tramway shares on the whole are very firm, and the 4¼ per cent. debenture stock of the British Columbia Electric Railway has gained 2 points. The foreign list is also better, with a welcome recovery in Anglo-Argentine Tramways, the first preference at 2 11/16 marking a gain of 3/16, while the 5 per cent. debenture at 66 is also harder. Brazil Tractions advanced a point to 47, and further substantial gains have been secured by Mexico Tramway first bonds at 37, which makes a rise of 10 points in the week, while Mexican Light first bonds at 37 are 4½ up. On the other hand, the issues of some of the Canadian industrials are lower. Calgary Power shares, for instance, at 27½ are 5 points down, and Canadian Car & Foundry preferred at 65 show a similar drop. The only weak spot in the Mexican group is Monterey 5 per cent. bonds at 26, this being 2½ lower on the week.

London electricity supply shares are good, with Westminsters at 6⅝ securing a 5s. rise. In the manufacturing group, General Electric Ordinary reacted 15s. to 19, although the Preference at 10⅜ are ⅛ better. India-Rubber shares have again advanced, and a rise of 10s. in Telegraph Constructions took the price to 42, the last-named being due to the dividend announcement. Other manufacturing shares are mostly good, with the exception of British Westinghouse Preference at 2⅝. British Aluminium Ordinary have risen to 33s. 1½d.

The telegraph list shows further improvement in the Eastern group, there being rises in Eastern Extensions, Eastern Telegraph Ordinary, and Globe Ordinary. Anglo-American Preferred is dull at 95. The rise in Oriental Telephones is resumed, and the price has hardened to 3⅛. Marconis have swung backwards, business in them being quiet again, which has caused the price to revert to 3⅛, with Americans a little easier at 25s. A noticeable improvement has taken place during the past few days in practically all the industrials connected with Egypt.

Rubber shares are quiet, without development of further [illegible], the price of the material has slipped back to 2s. 4¾d. per lb. Base-metal shares are mostly better, those in the silver, tin, and copper groups being prominently good. Business throughout the Stock Exchange, as mentioned above, is on the mend, and some of the markets which have been [illegible] for many a month are finding a moderate amount of activity in their long-neglected shares.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price Jan. 15, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3⅜	—	6 13 4
Chelsea	4	3	2¾	—	5 9 1
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3¾	—	5 6 8
Metropolitan	3	3	3¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅝	+ ¼	5 5 8

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price Jan. 15, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	95	— ½	6 6 6
do. Def.	33/6	1½	28⅜	—	6 8 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15⅛	+ ⅛	*5 5 9
Eastern Tel. Ord.	8	8	151½	+1	*5 5 8
Globe Tel. and T. Ord.	7	7	14	+ ¼	*5 0 0
do. Pref. ..	6	6	10¼	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	52½	—	6 3 10
Marconi	10	15	3⅛	— $\frac{1}{16}$	4 16 1
Oriental Telephone Ord. ..	10	10	3⅛	+ ⅛	3 4 0
United R. Plate Tel.	8	8	6⅞	+ $\frac{1}{16}$	*5 16 6
West India and Pan.	6d.	6d.	1$\frac{7}{16}$	—	*3 9 6
Western Telegraph	7	8	15¼	—	*5 5 0

Home Rails.

	Dividend 1915.	Dividend 1916.	Price Jan. 15, 1918.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	62½	+2	6 8 0
Metropolitan	1	1	23½	+ ¼	4 5 1
do. District	Nil	Nil	15¼	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	+ ⅛	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	82	—	*4 17 7

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916	Price	Rise or fall	Yield
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 9 1
Anglo Arg. Trams, First Pref.	5½	5½	2$\frac{11}{16}$	+ $\frac{3}{16}$	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	+ ½	7 11 6
Brazil Tractions	4	4	47	+1	—
Bombay Electric Pref.	6	6	9⅜	—	6 4
British Columbia Elec. Rly. Pfce.	5	5	43	+ ½	11 12 4
do. do. Preferred	Nil	Nil	28½	—1½	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	58	+2	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	+4½	Nil
do. 6 per cent. Bonds	Nil	Nil	32½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	37	+4½	—

Manufacturing Companies.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Babcock & Wilcox	15	15	3$\frac{5}{16}$	—	4 11 0
British Aluminium Ord. ..	7	10	1$\frac{21}{32}$	+ $\frac{1}{16}$	6 0 9
British Insulated Ord.	17½	20	3⅛	—	6 8 2
British Westinghouse Pref. ..	7½	7½	2⅝	— $\frac{1}{16}$	5 14 4
Callenders	20	20	14½	—	6 18 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8$\frac{3}{16}$	—	6 1 3
Edison Swan, fully paid ..	—	—	2⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅛	—	6 13 4
Gen. Elec. Pref.	6	6	10⅜	+ ⅛	5 15 8
do. Ord.	10	10	19	— ⅜	5 5 3
Henley	25	25	16½	-	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14⅝	+ ⅛	*6 16 9
Telegraph Con.	20	20	42	+ ½	*5 14 3

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	£	No. of weeks.	Total to date. £	£	Route miles open.	Inc.
Bristol	Dec. 28	22,204	+4,227	52	283,029	+29,433	30·5	..
Cork	,, 31	2,502	+ 381	52	28,965	+ 2,280	9·89	..
Dublin	,, 21	27,458	-2,811	51	343,395	+33,285	54·25	..
Hastings	,, 31	4,116	+ 464	52	63,688	+10,126	19·3	..
Lancashire United	,, 26	9,621	+2,965	52	122,565	+28,122	42	..
Llandudno-Col. Bay	,, 28	929	+ 108	4	929	+ 108	6·5	..
Anglo-Argentine ..	,, 31	227,702	+9,728	52	2,720,626	+48,221	..	..
Auckland	,, 26	22,308	+ 880	17	92,118	+ 7,832	26·59	..
Calcutta	,, 31	19,386	..	52	..	+ 6	.	..
Kalgoorlie, W.A. ..	Aug. 1	2,911	..	..	21,665	..	20.5	..
Madras	Sept. 30	4,695		31	41,629	+ 3,691	..	..
Montevideo ..	Dec.	34,025	-2,161	9	65,085	+ 5,317	..	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£58	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£38	..
a Copper Sulphate	,,	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£18	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/-	1½d. inc.
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks ..	per lb.	..	..

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/6¾ to 1/7¼	..
g ,, Bars (best selected) ..	per ton	£147	..
g ,, Sheet	,,	£147	..
g ,, Rod	,,	£147	..
d ,, (Electrolytic) Bars ..	,,	£125	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods	,,	£133	..
d ,, ,, H.C. Wire	per lb.	1/3⅞	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/8	2d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e ,, ,, ,, medium	,,	8/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Tramway Workers' Wages.—Sir George Askwith, Chief Industrial Commissioner, has been meeting representatives of the Tramway Workers' Union regarding their demand for an increase of war wages by £1 a week, applicable to all such workers throughout the country. There are in this connection something like 35,000 workers concerned, and the demand embraces the whole of the municipal and private tramway undertakings in the country. The tramway workers have received already advances upon pre-war rates of from 8s. to £1 per week.—*Morning Post.*

I.E.E. Dining-Arrangements.—In opening the last general meeting of the Institution, the President (Mr. C. H. Wordingham), referring to the proposals which had been made with a view to the members dining together after the meetings, said the Council was favourable to merging the usual Council dinner into a general dinner. There were difficulties in the way of carrying out the proposal at the moment; they had to decide whether they would be leading up to the greater scheme for an engineers' club, or whether by starting in a modest way under the present conditions, that scheme ran the risk of premature failure. It had been decided to consult the general body of members on the matter, and although the Council felt that, on the whole, the time was not opportune, he favoured the proposal, though recognising the difficulties in the way. *Those who wish to attend such dinners are asked to send in their names to the Secretary*, and if sufficient names are received, the experiment will be tried after the next meeting.

The President remarked that it had not been easy to find a suitable place to dine at, but that selection had finally fallen on the Waterloo Tavern, in the Haymarket, which had the advantage of electric cooking, though it was, unfortunately, some distance away, and at the present time they would have to share in the public room.

Football.—At Kingston-on-Thames, on Saturday last, Sopwith Ladies and Sterling Ladies participated in a game of football on behalf of the funds of the Queen Mary Hospital, Roehampton, as the result of which well over £10 was raised. It was a return match between two fine sides, the Ladies from the Sterling Works, Dagenham, maintaining their undefeated record by gaining a two to nil victory after a magnificent struggle, while the home Eleven suffered their second defeat of the season, both at the feet of the Dagenham Ladies.

ELECTRICAL SIGNALLING AND CONTROL ON RAILWAYS.

By C. M. JACOBS.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Electrical methods are generally to be preferred for the operation and control of all the indications required by drivers and signalmen in connection with the two main divisions of railway signalling, viz. :—

1. Block signalling, which has to do with keeping trains runnings on the same line of rails properly spaced; and
2. Interlocking signalling, the function of which is to ensure that the points over which the trains have to pass are properly secured, and to govern movements in and about station yards and junctions generally.

An example of the advantage of electrical methods is to be found in the alteration which has recently been effected in signal aspects in North America, where the three fundamental semaphore indications "Stop," "Proceed with Caution," and "Proceed," are now being given by a single arm. This is possible only by working the signals electrically. Fig. 1 gives a comparison between the British and American signal aspects. The simplicity of the latter will be apparent.

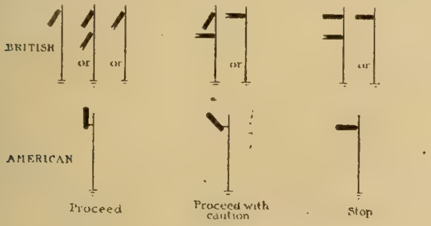


FIG. 1.

The cardinal principle of railway signalling is that the tendency of failure shall be to cause the "Stop" indication to be exhibited.

It is the business of the signalman to see that the semaphores give correct indications, and where there is any difficulty in his seeing them electric repeaters are provided; but these repeaters are not always as effective as they should be. Mere indication of the position of the signal, however, does not go far enough. In the case of block signalling it should not be possible to place a signal in the "Proceed" position unless at the same time the signal in advance is at "Stop." Fig. 2 shows an arrangement for effecting this, including an audible indicator which sounds when the lever and signal are not in agreement.

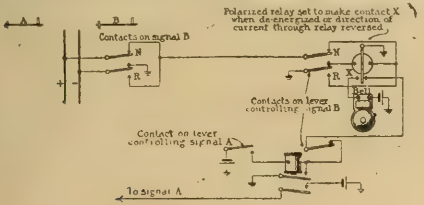

A
B
Contacts on signal B
N
R
+
−
Polarized relay set to make contact X when de-energized or direction of current through relay reversed
N
R
X
Bell
Contacts on lever controlling signal B
Contact on lever controlling signal A
To signal A

FIG. 2.

Where interlocking signalling is concerned, it is necessary not only to prevent conflicting signals being off together, but also to have the signals in the "Stop" position if the points on the route controlled by the signal are not in their correct position. These safeguards can only be made thoroughly effective by working the signals, and detecting the points, electrically.

In an installation of electric detection of points and signals, a large number of wires have, of necessity, to be run close together, and precautions are required to prevent crosses or earths from causing the improper operation of the detector relays. On this account, and also in order to admit of faults being more easily traced, "common" conductors are to be avoided, while an independent source of energy for each indication circuit is to be preferred.

The McKenzie & Holland and the Westinghouse Power Signal Co.'s arrangement for this, where alternating current with a separate transformer is used for each indication circuit, is shown in fig. 3.

In the event of there being no independent sources of energy, each circuit should get current from independent tappings from the mains. Both these arrangements give continuous control or indication, and both are reasonably free from dangerous failure due to earths or crosses.

Electrical methods of point indication and control are mostly confined to power systems of signalling. They are, however, being introduced in connection with mechanical signalling installations.

Track Circuit.—Signalling movements are further controlled by the presence on the rails of trains and vehicles themselves by means of track circuits.

The track circuit ideal is to detect anything on wheels across the rails. As generally installed, however, with a 4-ohm or 9-ohm relay and a 1-volt battery, a track circuit cannot be depended upon to detect anything which does not put virtually a dead short-circuit across the rails. The result is, that not only is such a track circuit unreliable for taking care of a single vehicle (which in combination with an unclean rail may mean a train shunt of anything up to 5 ohms), but it may occasionally fail to take care of a light engine, or even a complete train.

Track circuits may be divided into three classes :—

(*a*) Those which may be acted upon by complete trains only.

(*b*) Those which may be acted upon by a single vehicle.

(*c*) Facing-point track circuits, which being short have a comparatively high ballast resistance.

In order that these track circuits may be quite reliable, they should be adjusted for minimum train shunts at infinite ballast of 5, 10, and 20 ohms respectively.

The adoption of anything approaching such standards will necessitate a higher ballast resistance, possible perhaps only by sub-division of the track circuit, a higher resistance relay, a higher battery resistance, and a track battery having a higher electromotive force.

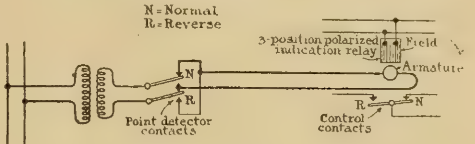


FIG. 3.

This will be evident from the curves in fig. 4, from which can be obtained all the factors for any track circuit. These curves show the shunt required to reduce the current through the relay to any fraction of the current which would pass through the relay unshunted. The shunt resistances and the battery series resistances are in terms of the relay resistance.

These curves show that the rule that the higher the battery series resistance the more sensitive is the relay to shunting, does not completely represent the law of the shunt as applied to track-circuit conditions.

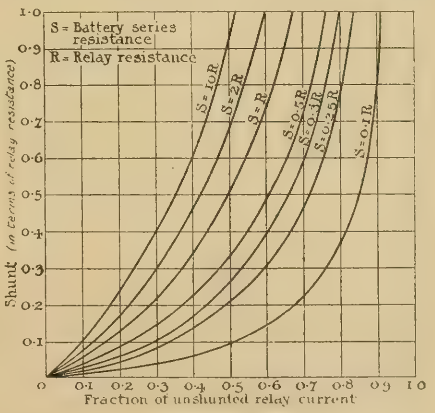


FIG. 4.

In track circuiting, the problem is to reduce the fraction of the unshunted relay current which passes through the relay when it is shunted by a predetermined minimum ballast resistance (this fraction of the unshunted relay current being known as the pick-up current) to a lower fraction known as the armature release current, which is usually 60 per cent. of the minimum pick-up. The percentage difference between the shunts corresponding to the minimum pick-up and armature release is the same for all curves for the same fractions of unshunted relay current. For efficient shunting, the lower part of the curves should be used; the fraction of unshunted relay current through the relay at minimum ballast should not be greater than 0.2.

Consider the curve in which the battery series resistance is 0.5 of the relay resistance, and let the minimum ballast shunt be 20 ohms and correspond to 0.2 of unshunted relay current, then the shunt at minimum ballast (20 ohms) equals

0.0833 of the relay resistance, which makes the latter 240 ohms.

The standard type of track relay of this resistance requires about 0.01 ampere as the minimum pick-up current, so that the unshunted relay current must be 0.05 ampere, to drive which through the unshunted relay plus the battery series (0.5 relay), *i.e.*, a total of 360 ohms, calls for a battery pressure of 18 volts. If the armature release current is 60 per cent. of the pick-up current it equals 0.12 of the unshunted relay current, the corresponding shunt being, from the curve, 0.045 of the relay resistance, *i.e.*, about 11 ohms.

It is not sufficient to reduce the difference between the pick-up and release properties of the relay, if no regard be had to the value of the shunts which produce the maximum differences in the currents through the relay.

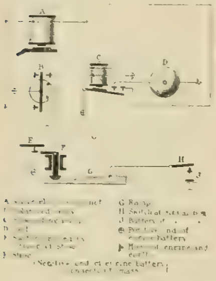


Fig. 5.

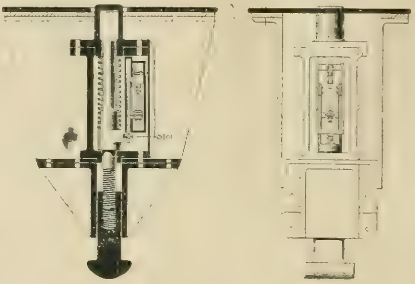


Fig. 6.

The ratio between the battery series and relay resistances only determines the voltage of the track battery. The most economical arrangement is when the battery series is about one-third of the relay resistance.

Automatic Train Control.—Experience has shown it to be desirable that signal control should be exercised directly in the cab of the railway locomotive.

The Great Western Railway has had in use for the last 10 years a fairly extensive installation of automatic train control, a general outline of which will be found in Mr. Acfield's paper* on "Development of Main Line Signalling on Railways." Some further information in regard to it may be of interest.

Safety in railway locomotion is dependent upon a good look-out, and on that account there should be a minimum of interference with the driver consistent with the object sought to be obtained. This minimum is the indication of the distant signal which it is assumed may be missed by the driver. The Great Western system has accordingly been purposely limited to this signal. Further, the control apparatus should be subservient to the driver, who must remain primarily responsible for the running of the train; he may be warned in such a way that his train will be automatically pulled up if he is not taking notice, but when he is alert there must be no question of taking control of the train out of his hands.

The operation of the control on the train must be dependent neither upon a movable appliance on the line (on account of the known weakness of movable appliances, particularly mechanically-operated signals) nor upon the positive making of an electric contact. Also the control apparatus should be practically tested each time a signalling position is passed, and "Proceed with Caution" should then be indicated if there is any failure.

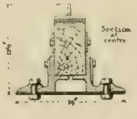


Fig. 7.

Fig. 5 shows the latest arrangement of the cab apparatus. The primary operation is the de-energisation of the electromagnet controlling the valve admitting air to the train pipe. In the case of trains moving at high speeds (80 miles per hour and upwards) over a 40-ft. ramp the period of effective opening of the switch in circuit with the electromagnet may be less than 1/5 second. There has been no difficulty in the armature releasing with this period of interruption. Any difficulty experienced so far has been to maintain an uninterrupted electrical contact with the ramp during the time the switch is open. This has been met by introducing a slow-acting relay, a current impulse through which, due to the operation of the armature of the polarised relay connected with the mass of the contact shoe, is sufficient to cause the armature of the slow-acting relay to keep the switch—during the time it is mechanically open—short-circuited.

The slow-acting relay also controls a bell circuit, so that when the current is picked up from the ramp the bell sounds for a definite period. This is a positive "Proceed" indication, useful in foggy weather and during falling snow, besides showing that the apparatus is in order. In some quarters a positive "Proceed" indication is not considered necessary or desirable, but it may be pointed out that an apparatus which only indicates "Stop," in the absence of this indication implies by inference that the signal is at "Proceed," a questionable method of signalling.

The plunger of the contact shoe (fig. 6) is provided with a spring having an initial compression of 1½ in. under a load of 250 lb., and a final compression of 3 in. under 530 lb. So strong a spring has been found to be necessary, not so much for obtaining a good electrical contact between the shoe and the ramp, as to keep steady the plunger to which the switch is attached and prevent the latter momentarily opening. By making a slotted connection between the plunger and the switch as shown, instead of directly attaching one to the other, combined with the characteristics of the slow-acting relay, it is found possible to use a weaker spring, thus reducing the wear on the case-hardened face of the shoe. The insulation resistance between the shoe and the mass of the engine averages about 2,000 ohms.

The ramp (fig. 7) has an insulation in wet weather of about 1,000 ohms. The line pressure at the ramp is about 18 volts. It is limited by the difficulty in mantaining primary batteries in country districts, otherwise a higher pressure would be preferable.

The disposition of the shoe and ramp, viz., in the centre of the running rails, is the most practicable and convenient, and this, as safe signalling is an important factor in railway operation, may become a reason favouring the adoption of alternating current for railway electrification.

The efficiency of signalling apparatus is largely limited by the output which can be obtained from primary batteries. There is an enormous number of these cells in use, as each signalling circuit usually has its own individual battery. In large centres it should be more economical, and improved apparatus would result if, in place of individual batteries with limited output, current were obtained from a central battery of accumulators. There are also cases where it might be an advantage to use an alternating-current supply.

A good deal more is generally expected of an electric signalling appliance than of a mechanical one, and rightly so. There is, however, sometimes a tendency to expect what almost amounts to infallibility.

No electrical system of signalling can be absolutely safe or absolutely fool-proof, and unless it be intelligently designed, installed, and maintained, it can only be comparatively safer than mechanical systems or a code of rules. An electrical system cannot eliminate the human element, because it has to be put in and looked after by a human being.

NEW ZEALAND WATER-POWER REPORTS.

The hydro-electric possibilities of the Dominion of New Zealand have been very much to the front in the last few years. A recent Public Works statement submitted to the House of Representatives shows that at the completion of its second year of working, the maximum load on the Lake Coleridge undertaking reached 6,250 h.p., which is in excess of the rated capacity of the three sets installed there.

Since the completion of the financial year, however, a fourth unit has been put into service, making a total of 8,000 h.p. installed, and a fifth unit of 4,000 h.p., together with material for a pipe line, is also on order, though some delay is anticipated in obtaining it. During the year the Christchurch Tramway Board, and several freezing works and flour mills, have been connected to the system; the feeder lines have been slightly extended, and urgent requests have been received for power from municipalities and others on the route of the Christchurch-Timaru transmission. The demand for power threatents to exceed the capacity of the present machinery, and a contract was to be entered into with the Christchurch Tramway Board and City Council for the use of their steam plant for stand-by purposes.

On the year's working a balance of £7,865 was carried to net revenue account, and there is every indication that the undertaking will meet its interest and depreciation charges during the present year.

During the year considerable progress has been made with the surveys and other preliminary work in connection with the development of hydro-electric works in the North Island. Surveys have been completed for headworks on the Mangahao River, at Arapuni, on the Waikato River, and a survey of the transmission line between Shannon and Wellington has been completed, whilst a survey of a transmission line between Auckland and the Waikato River is in progress.

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* Electrical Review, April 16th and 23rd, 1915.

Investigations have been directed towards determining the best method of providing a general supply of electricity for the North Island. The indications point to the advisability of developing three sources, namely, the Waikato River, Waikaremoana, and the Mangahao in the south. Other water-power sources will, in all probability, be developed in course of time, but these three sources would constitute the principal sources. A start has been made with the work of ascertaining the power requirements in the Wellington district, and a systematic canvass is being made of the power-users and their requirements.

In a report by Mr. E. Parry, the Government electrical engineer, on the hydro-electric development of the North Island, some particulars of the possibilities of the three sources referred to above are given.

Mr. Parry points out that the best scheme is one in which at the outset three sources would be developed for supplying respectively the Auckland district, the Hawke's Bay district, and the Wellington district; these sources would be linked-up.

Waikaremoana is the best source for Hawke's Bay, but as the amount of power is greatly in excess of the requirements, it should be regarded as a supplementary source for supplying the Wellington district.

As regards the Wellington district, investigation has shown the most suitable source of supply for the southern area to be Mangahao river, which rises on Mount Dundas.

By a diversion through the hills for three miles, the fall of 1,040 ft. between the Mangahao and the loop of the Manawatu, near Shannon, is made available. It is proposed to tunnel through the hills into the Tokomaru Valley, there diverting part of the Tokomaru, and then from the Tokomaru Valley through into the Mangaore Valley, where the power station would be situated within three miles of the railway at Shannon. Observations in a dry season show 25,000 H.P. on a 50 per cent. load factor as available, which will be sufficient for the district for some time, and can be supplemented later. The natural extensions of the three transmissions from the three sources will ultimately link them together, so that an additional supply will be available for the Wellington district from the other sources.

In course of time it would be possible to provide additional power from the Taranaki district, where there is more than one promising source.

Instead of installing a stand-by hydro-electric unit, Mr. Parry proposes to utilise the existing steam plant at Wellington to provide against temporary interruptions.

The cost of headworks, power station, and plant for 25,000 H.P. would be at normal prices £420,000, or under £20 per H.P., and this illustrates the advantage of concentrating the power supply for a considerable district in one source; in a smaller development the cost of the hydro-electric works would be excessive.

In the first place it is proposed to run trunk transmissions to Wellington, Palmerston North, Wanganui, and Masterton as chief centres.

The cost of providing the trunk and distributing lines and sub-stations throughout this area would be £580,000, making a total of £1,000,000, which expenditure is at the rate of £40 per H.P.

Capital charges at 7½ per cent. work out at £3 per H.P.-year; the annual cost of maintenance and operation would amount to £25,000 per annum, or the equivalent of £1 per H.P.-year, thus making £4 per H.P.-year for both charges. Experience shows that in Christchurch this revenue can be secured without difficulty, even where economical fuel plants are already installed.

Mr. Parry considers that the Waikaremoana scheme should be made dependent upon the construction of the Napier-Gisborne Railway, which would open up a better road for the transmissions. The Auckland and Wellington schemes should proceed simultaneously.

Reporting on the development of the Waikato River at the Arapuni Gorge, about 18 miles from Hora-Hora (for supply to the Auckland district), Mr. Parry says this source has much in its favour; the capital cost of the ultimate development would be remarkably low, but it would require the construction of a dam 146 ft. high.

Neither the Kaituna River nor the Waikato River at Aratiatia Rapids compares favourably with Arapuni as regards capital cost per H.P.

Mr. Ellis, of Hamilton, in discussing the matter, says the Arapuni site would develop 120,000 H.P., or even 150,000 H.P., its drawback being that under the present proposal to put in a 30,000-H.P. plant, the latter would have to carry proportionately heavier capital charges, bringing the cost up to the same as the Mangahao plant. If, however, 60,000 H.P. could be developed, the all-in cost per H.P.-year would be £2 17s. 6d., for 365 days of 24 hours.

In the discussion on the Public Works estimates, it was stated that the Auckland area would in a brief time absorb 40,000 H.P.

An Italian Trade Opening.—According to the *Board of Trade Journal*, the Acting British Consul at Turin states that a local engineer seeks the representation of United Kingdom manufacturers of electrical machinery and hydraulic plant.

ELECTRICAL MANUFACTURING IN AUSTRALIA.

We are indebted to the *Sydney Morning Herald* for the following extracts from an interesting address delivered on November 9th by Mr. Wm. Corin, the retiring president of the Electrical Association. The speaker said there was no doubt that the war had given an impetus to the manufacture in Australia of electrical apparatus, and that orders had been lodged with makers in the Commonwealth which would otherwise have been placed abroad. It need scarcely be said that had the firms been prepared they would have received a tremendous volume of work, but at present they were unable to quote for anything large. For this they could not be blamed, for no one in Australia expected the war to come, or, if it came, to last as long as it had, but in other respects local enterprise had failed in connection with some of the simplest of electrical manufactures. Nothing, for example, could exceed the simplicity of the electrical furnace. Had the arrangement projected between the Queensland Government and a Sydney syndicate in 1906 been carried into effect, all the carbide of calcium required for the Commonwealth would now be manufactured with power from the Barron Falls. Imports of this material for the nine years from the date of his report to the Queensland Government on this matter, *i.e.*, from January, 1907, to June, 1916 (omitting six months not included in the return), had totalled 92,186 tons, valued in the Customs returns at £1,160,312. Whereas the price of manufacture in 1907 would have been approximately £9 per ton, and probably £11 now, the market price of carbide had risen from about £13 to £30 to-day, and even at this price it was scarcely obtainable. During the same nine years there had been imported into the Commonwealth caustic soda, which could also be manufactured as an electrolytic product, totalling 37,848 tons, valued at £451,881. Tasmania had now made a start with the manufacture of carbide, as well as with other similar industries, but beyond a small experimental carbide furnace tried some years ago in Sydney, the only serious attempt at electrothermic manufacture in New South Wales that he was aware of was the manufacture of high-grade steel by the Australian Electric Steel Co. at Alexandria. This company had laid down a two-ton furnace, turning out six tons of steel a day. The venture had been so successful that the company was duplicating the plant. They used 2,000,000 units of electrical energy per annum, and were making special steel for axles and tires, chrome-steel for rolls for steel rolling mills, manganese steel, and other high-grade steels. There was a distinct field for electric manufacture in this direction, and in the development in New South Wales of the large electrochemical and electrothermic industries, requiring a steady supply of power, it was probable that eventually the water powers of the State would be brought into operation in spite of the fact that coal was comparatively cheap.

"Soon after I arrived in Australia," Mr. Corin went on to say, "learning of the large copper production, I naively inquired why it should be sent away, and not manufactured here. The reply was immediate, that the whole of the copper market was controlled from Germany, and that there was no possibility of manufactured copper being produced in Australia. The Prime Minister has been instrumental in relieving the country of this incubus, with the result that a start has already been made to produce all classes of manufactured copper at Port Kembla, and before long all the copper required for internal use will be manufactured in the Commonwealth. Steel and iron are already available here, and their production can be increased to any extent. Further, all classes of insulating materials (mica, insulating oils and gums, &c.) are to be found in Australia. Why, therefore, should not all the turbines, generators, motors, and electrical machinery generally required for the development of the Commonwealth be manufactured within it? When the war is over active competition from established works outside Australia will be intensified owing to many manufacturing countries making a bid for Australian trade. Australia will not be ready for some years to manufacture on a large scale, and the only way of meeting this competition and fostering local manufacture, if Australia is to produce her own machinery, will be either by a heavy protective duty or by reduction in the cost of labour.

"Timid unionism, in its fears for the result of untrammelled development, has in the past dictated that in cases, even for work which could be carried out by boys, none but skilled men should be employed. Surely unionism will learn from the object-lessons now before it, and will put its shoulder to the wheel for the benefit of Australia. Again, the limitation of apprentices is unjustifiable. If there be abuse of the apprentice system, let it be made the subject of legal enactment. There should be always a surplus of learners employed at any trade, to allow not only for those who do not turn out well or who fail to continue at it, but also to prepare for the expansion which must come if Australia is to progress as a self-contained manufacturing country. The present system is killing the possibility of expansion."

GAS FIRING BOILERS.

Mr. T. M. Hunter's paper on "Gas Firing Boilers" was discussed at a meeting of the Scottish Local Section of the Institution of Electrical Engineers on December 11th.

Mr. J. H. R. Kemnal (Glasgow) said it was generally conceded that there was very little advantage in producing gas merely for the sake of firing boilers. It could only be made to pay if by-products were recovered, and if the value of the by-products reached a certain figure. One must bear in mind that blast-furnace gas was a by-product; there usually was such a surplus of gas at blast-furnaces, that the highest possible efficiency was not a necessity to the successful working of the plant, and the introduction of refinements to attain a high percentage efficiency would not be justified. He was prepared to prove from experience that the water-tube boiler had a great advantage over the Lancashire boiler for utilising blast-furnace gas; the three-flue Lancashire boiler was now little used, whereas with water-tube boilers improvements had been effected, and they could get rid of dust by steam blowers. The hardening of flue dust on the tubes was caused by initial neglect. His experience was at variance with that of Mr. Hunter, and he thought it would be a great mistake to design a boiler on Yarrow lines for utilising blast-furnace gas. A point in connection with blast-furnace gas was that for every 100 therms of utilisable gas they had to carry a great deal more unutilisable gas, and that was a reason why large passages were essential. In Babcock and Wilcox boilers, by placing the tubes at more than the ordinary pitch they had got considerably improved results. He recalled an instance of washing blast-furnace gas where an elaborate installation for this purpose was put in. The results obtained were less with the washed than with the unwashed gas, mainly due, he thought, to a great deal of heat being lost in washing. Another method was using gas which approached lighting gas in value, and in this connection he had been investigating results reported as having been got by the Bonecourt boiler. He had no means of disproving the figures published as to the total efficiency of this boiler, but he had considerable doubt as to the results being exactly as described, and was convinced that it was impracticable except in a few cases. One of the points of impracticability was that it could not be made in units above a certain size. He did not think it would be capable of producing 20,000 lb. of steam per hour, which to-day was looked on as a small unit. As an application of the burning of gas under theoretical conditions it was ideal. As to the burning of blast-furnace gas under boilers, one could not say that one particular design of furnace was better than another. In the utilisation of gas they could not apply any particular practice to all cases. The investigation of each individual case was essential.

Mr. F. Anslow said it was correct to state that gas could be utilised at furnaces and give all the steam power required, but while that was so up till a certain period, it was not so to-day. The introduction of ammonia recovery plants had meant the use of much steam power, and the increase of other power plant had resulted in the recovery of almost all recoverable waste heat. He did not think the introduction of specially installed producer gas plants for steam raising would be particularly profitable. Under present conditions it was extremely difficult to form a definite opinion on the relationship between the price of coal and that of by-products.

Mr. W. M. Selvey pointed out that while they could not vary the Lancashire boiler, the water-tube boiler enabled them to design it, so far as the division of surface was concerned, to meet any conceivable conditions. What they were out for was to get the biggest output possible for a given capital expenditure for the desired purpose. The question of utilising waste heat was going to become one of great national importance, and they might yet see it run on lines parallel to gas-engine stations.

Mr. Hunter, in the course of his reply, said that if they were working with clean gas they could use economisers in a different way than they did in working with coal firing, as there was no dust to accumulate. He would never dream of trying to fire a Yarrow boiler with uncleaned gas, because they could not get at the passages to clean them. He was of opinion, however, that under certain conditions a high efficiency with clean gas could be obtained from that type of boiler. He agreed with Mr. Kemnal that there was no one combustion arrangement which could be applied to different cases. He would not say that one particular boiler might suit a particular plant without full information of requirements. While he was up against existing boilers, he did not think it would be a commercial proposition to pull out Lancashires and install water tubes. The water-tube boiler had the pull in burning uncleaned blast-furnace gas, but it paid to clean the gas for a Lancashire.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

31. "Electric heating elements." L. G. Caunter. January 2nd.

32. "Electric arc for curative and therapeutical purposes." H. C. Ross. January 2nd.

34. "Sparking plugs." W. G. Kent & F. Martin. January 2nd.

36. "Systems for amplification of small currents." British Thomson-Houston Co. (General Electric Co., U.S.A.) January 2nd.

57. "Accumulating and utilising electric energy in the form of recovered heat." R. Arno. January 2nd.

71. "Alternating-current motors." A. C. Bell & T. R. Bell. January 2nd.

79. "Arrangement for securing electric contact in overhead trolleys for tramcars, &c." A. C. Franklin. January 2nd.

112. "Electric couplings." R. W. Whitley. January 2nd.

120. "Vacuum tubes." G. A. Beauvais. January 2nd. (France, August 1st, 1917.)

121. "Vacuum tubes." G. A. Beauvais. January 2nd. (France, August 4th, 1917.)

139. "Semi-automatic telephone systems." L. Polinkowsky & Western Electric Co. January 2nd.

169. "Electric circulating water heaters." Simplex Conduits, Ltd., and L. M. Waterhouse. January 3rd.

180. "Sparking-plug pin." F. E. Moore. January 3rd.

183. "Electric lampholders." B. J. Grigsby. January 3rd.

210. "Wire attaching device for sparking plugs of explosive motors." A. Jouveau & C. Tournoud. January 3rd. (France, August 11th, 1916.)

213. "Electric welding." E. Jones, A. Ramsdale & J. P. Toole. January 4th.

244. "Electric conductor." H. George & J. Hebert. January 4th. (France, April 16th, 1917.)

245. "Electric transformers." F. E. Berry. January 4th.

248. "Electric protective apparatus for alternating currents." H. Pearce. January 4th.

261. "Free-release circuit breakers." Allmanna Svenska Elektriska Aktiebolaget & G. Seligman. January 4th.

262. "Electric syrens." Allmanna Svenska Elektriska Aktiebolaget and W. H. Petersen. January 4th.

283. "Attachable hook or holder for electric torch lamps, &c." M. H. Goldstone. January 5th.

290. "Process for separating electro-deposited metals from their matrix." S. O. Cowper-Coles. January 5th.

306. "Automatic time switches for controlling X-ray exposures, &c." Newton & Wright. January 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,709. Electrical Instrument for Indicating Instantaneous Pressures or Currents. J. T. Irwin. December 9th, 1916. (111,886.)

17,749. Wireless Telegraphy Transmitters. Marconi's Wireless Telegraph Co. & W. S. Entwistle. December 9th, 1916. (111,887.)

17,803. Telephone Memo-filing Receptacle. S. M. Brydges. December 11th, 1916. (111,891.)

17,929. Electrical Apparatus having Windings. British Electric Transformer Co. & J. Goodman December 13th, 1916. (111,899.)

17,930. Protective Means for Electrical Apparatus having Windings. British Electric Transformer Co. & J. Goodman. December 13th, 1916. (111,900.)

17,937. High-frequency Alternators. Soc. Francaise Radio-Electrique. September 16th, 1915. (102,738.)

18,208. Dynamo-electric Machinery. A. H. Neuland. December 19th, 1916. (111,915.)

18,423. Current-saving Devices for Electric Welding. C. Roulland. December 22nd, 1916. (111,925.)

1917.

18. Electric Cables. British Insulated & Helsby Cables, Ltd., & J. Brotherton. January 2nd, 1917. (111,929.)

313. Telephone System. Aktieselskabet Elektrisk Bureau. January 15th, 1916. (103,482.)

468. Sparking Plugs for Internal-combustion Engines and the like. R. F. Stiller, A. M. Patton & C. Hurst, Ltd. January 10th, 1917. (111,936.)

752. Single-stroke Electric Bells. G. Henderson. January 13th, 1916. (103,487.)

1,080. Electric Terminals or Connections. H. C. Bell. January 22nd, 1917. (111,942.)

1,748. Electric Bells. J. Davis & Son and W. H. Davis. February 3rd, 1917. (111,948.)

4,557. Engine Starter. V. Benedix. March 29th, 1917. (111,967.)

5,254. Electric Current Interrupters. K. Trosdahl. April 13th, 1917. (111,968.)

8,001. Shade Carriers for Electric Lights. C. G. M. Bennett. June 4th, 1917. (111,978.)

11,465. Interrupter for Electric Circuits. R. Bosh (firm of). August 9th, 1917. (Addition to 25,880/11.) (111,988.)

12,054. Machine Switching Telephone Systems. Western Electric Co. (Western Electric Co., U.S.A.) August 22nd, 1917. (111,991.)

12,351. Time-limit Electric Circuit Breakers. Akt. Ges. Brown, Boveri et Cie. February 20th, 1917. (Addition to 14,498/15.) (111,993.)

14,588. Tool for Clinching Terminals for Electric and other Couplings. Ross, Courtney & Co. and J. A. Ross. October 9th, 1917. (112,000.)

The A.S.E. and Man Power.—In introducing the new Military Service Act in the House of Commons on Monday, Sir Auckland Geddes referred to the most regrettable circumstance that the Amalgamated Society of Engineers had refused to take part in the conferences which he had been holding with the Trade Unions respecting measures to be taken to withdraw young men from the essential industries for military service. We cannot believe that workers in the engineering industries who have rendered such necessary service to the Allied cause during the past year or two will fail that cause at the present crisis. Sir Auckland has the support and sympathy of the nation in his proposals for carrying out the intentions of the War Cabinet, and it would be deplorable to think that engineers, of all men, played into the hands of the enemy. History would record the fact to their eternal disgrace.

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NATIONAL EDUCATION.

IT is universally admitted that one of the most important of the many problems that are pressing for solution, in connection with the maintenance of the prosperity of this country after the war, and its speedy liberation from the immense burden of debt that is accumulating at such a terrific rate, is the drastic reform of our system of national education. This is a matter which affects our industrial future at least as intimately as any other sphere of national interest, and we are very glad to see that this fact is fully appreciated by so influential a body as the Federation of British Industries, which has recently issued a memorandum, drawn up by the Education Committee of the Federation, on the scheme put forward by the President of the Board of Education. We are informed that the memorandum has received the support of over 2,000 firms engaged in industry throughout the country, a fact which justifies the claim that it is the first authoritative pronouncement of industry upon Mr. Fisher's proposals.

The Committee emphasises the urgency of the question, and in order to secure tangible results as quickly as possible, it has wisely refrained from advocating unattainable ideals at the moment; the greatest stress is laid on the most pressing reforms, namely, the improvement of elementary education, and the provision of a full secondary education for the more able children. The Committee heartily supports Mr. Fisher's proposal to establish compulsory education for all up to the age of 14 years, but cannot accept his further proposal to impose compulsory part-time education on all children up to the age of 18, which, it is feared, would cause a very serious dislocation in many trades at a time when smooth working is of the utmost importance. As regards Mr. Fisher's views on secondary education in general, however, the Committee is in agreement with him, and endorses the principle that every child in the country, of whatever class, should have an opportunity of complete education if it is able to profit thereby.

Instead, therefore, of universal compulsory part-time continuation education, the Committee advocates a liberal system of whole-time education for selected children. Obviously, it is vastly more important that the brighter intellects should be singled out for higher training than that an attempt should be made to bring all and sundry up to a modest level of mediocrity; by the former plan efficiency can be attained on scientific lines, and the great objection to any system which treats all alike, namely, that the clever pupils are kept back by the necessity of waiting for the dull ones, surely the most deadening and discouraging of all restraints, can be avoided. At the same time, the teaching staff, which is numerically far short of the requirements, and is likely to remain so, will be more efficiently employed, and will go further towards fulfilling the demands, as a teacher can deal effectively with a much larger class of intelligent pupils than of mixed good and bad.

In this connection the Committee warmly commends the system of whole-time education for selected children which has been adopted by the London County Council, and which is credited with "very excellent results." On the other hand, the Committee is not hostile to the adoption of compulsory part-time education for the children who are not selected for the full-time course, provided that the greatest care is taken to introduce it by degrees, and with full regard to local conditions. The importance of improved physical training is also recognised in the Memorandum. There can be few of our readers, we should think, who have not noticed the extraordinary improvement which is effected in the physique of the average young man by a few months' training for the Army or the Navy, and there is no reason whatever why this most desirable advantage should not be available to our youth in peace-time also. For many years we have held that, apart altogether from the military aspect of the matter, the adoption of a limited system of compulsory universal service would be of priceless value in developing the physical characteristics of the nation's youth, besides imbuing it with the qualities of patriotism and discipline.

In addition to the provision of sound elementary education for all, and of secondary education for a selected number of really able children, the Memorandum contemplates the adoption of means to enable the best of the latter to proceed to a still higher plane of training at the university or technical college, thus affording to every child, of whatever station in life, an equal opportunity of developing his latent talents and equipping himself with the highest resources of scientific and technical progress, a principle which cannot be too cordially endorsed. Here one necessarily must have regard to the fact that many parents of highly-gifted children cannot afford to forgo the earning power of their progeny, with the result that only too often a promising career is cut short by the withdrawal of the child from the educational course along which he is advancing. To meet this objection the Committee offers the drastic expedient of subsidising the parent, in addition to defraying the whole of the cost of education, in cases where the need is met with. While this method must entail a considerable increase in the expenditure, it cannot be doubted that the community would eventually reap a rich return from the investment.

We are glad to note that the Committee realises the absolute necessity of raising the standard of quality, as well as the numbers, in the teaching profession. So long as teaching remains the most ill-paid of skilled occupations, as well as one of the most arduous and unattractive, it is utterly useless to hope for material progress. The multiplicity of educational authorities, largely due to the rivalry of religious denominations, but also arising out of excessive sub-division of control, is another matter referred to in the Memorandum as calling for investigation and reform. Lastly, the Committee emphasises the importance of interesting employers in educational questions, and securing their financial support, to which about 90 per cent. of those who have been consulted have agreed.

The Memorandum is in all respects a most useful contribution to the study of the subject with which it deals; it follows to some extent on the lines of previous reports, but, without going into excessive detail, it appears to adopt a broader view, and to secure a better grasp of the existing situation and its needs, while its origin, and its foundation on the basis of the views of so many industrial firms, lend weight to its proposals. No doubt it will receive the close attention of the Ministry of Education, and of the Central Organisation that was formed at the conference of engineers last autumn.

Our Trade Commissioners.

In connection with the important measures that have been adopted by the Government for greatly extended assistance to be accorded to industry through the instrumentality of 16, instead of four, Trade Commissioners, an announcement has been made this week indicating a number of the appointments that have been made. It was a foregone conclusion that the four experienced officials who in recent years have been serving us so well in a similar capacity should remain and continue their good work, though not in every case in the scene of their present labours. We believe that the selection of Mr. C. Hamilton Wickes to remain attached to the headquarters at the Department of Overseas Trade (Development and Intelligence) will evoke expressions of general satisfaction. Mr. Wickes had had a wide general connection with commercial affairs in this country for years before he went out to represent our interests in Australia, and he followed his Australian experience with several years in the vast Canadian field. He is, therefore, thoroughly familiar with two of our most important markets where after-the-war trade developments should be of enormous importance for us at home, but his knowledge is not limited even to this wide ground, for we suppose there is hardly a Government official who during the last few years has been brought into more direct touch with our manufacturers and their products in the great industrial and commercial centres of the United Kingdom. As our readers are aware, he has the added merit of knowing many aspects of electrical industrial questions as a result of personal investigation. All of these things taken together render him, in our opinion, pre-eminently suited to fill the office indicated above in London during the present more or less critical period of organisation and re-organisation.

The Canadian territory is so vast that it can hardly be efficiently covered for present-day trade purposes by one Commissioner. In a short time Mr. G. T. Milne, who has latterly been acting in Australia, is to transfer his services to Canada, and will act as Senior Trade Commissioner, with headquarters at Montreal. Mr. W. G. Wickham and Mr. R. W. Dalton will both continue to serve in their present capacities in South Africa and New Zealand respectively, but Mr. S. W. B. McGregor is announced to follow Mr. Milne at Melbourne "shortly." He will be a "Senior" Commissioner, as will Mr. Milne in Canada. As recent announcements have indicated, India is to be attended to in future, and in this connection Mr. T. M. Ainscough, O.B.E., who has been entrusted with foreign trade missions in the past, shortly proceeds to Calcutta to become "Senior" for India. Two new appointments are these: Mr. F. W. Field, who is now Imperial Trade Correspondent at Toronto, will become a Trade Commissioner at the same place, and Mr. L. J. Wilson Goode will serve as Acting Trade Commissioner in South Africa while Mr. Wickham is at home on an official visit. We thus have the names of one-half of the men who are to be our 16 Commissioners, assuming that Mr. Hamilton Wickes continues to act under that title. In the main, the appointments represent the strengthening of the service by establishing more substantially and satisfactorily the positions of the men of tried experience. We shall await with interest the remaining eight appointments, which may bring into the service men who will command respect at any rate equal from the industrial and commercial world.

THE SELECTION OF AN ELECTRICITY METER.

By W. G. N.

Electricity meters are usually bought in quantities on period contract terms. This makes a right choice particularly desirable, because of the large numbers of meters involved, the long period which must elapse before any desired change can be made, and, for reasons of standardisation, the disadvantage of frequent changes.

Doubtless every meter man has his favourite meter, and could give reasons for his preference, but probably few have gone to the trouble of accurately "placing" in order of merit the various meters submitted for their examination from time to time.

A comprehensive method by which different meters may be "placed" is hereinafter described. Some such method is necessary if the purchaser is to be certain that the meter chosen is the most suitable.

By carrying out an investigation on the lines indicated, and giving position marks to each meter for every qualification, final totals can be obtained which will settle the question without gainsay. Thus, if six meters are being considered, the maximum number of marks for each qualification will be six, if there are five meters, the maximum will be five, and so on. The relative importance of each qualification may, of course, vary with circumstances. If a certain qualification is regarded as more important than others, the position marks of each meter may be multiplied be a suitable factor for this particular qualification. The meter which obtains the greatest total number of marks will be the best meter.

The qualifications of a meter fall under two main heads—namely, Quality and Cost. There are certain other considerations relating to the Commercial Service given by different manufacturers.

Quality.

The Quality of a meter may be considered under three sub-divisions—viz., Accuracy, Finish, and Convenience.

Accuracy is undoubtedly the most essential qualification of a meter, and it assumes its true proportions when it is remembered that an improvement of 1 per cent. in the accuracy of the meters may result in the collection of additional revenue equivalent to a saving of 10 per cent. in the coal consumption.

A meter which is not reasonably accurate belies its name; but in comparing the accuracy of meters it should be remembered that not only should the initial accuracy be considered, but also the accuracy after service.

Most supply authorities have facilities for testing the initial accuracy of samples submitted, but to estimate the ultimate accuracy requires sound judgment, based on the design of the meter and the evidence furnished by the maker.

Initial Accuracy.—To test the initial accuracy thoroughly, variation of registration should be noted with—

For continuous current meters.	For alternating current meters.
Variations of load	Variations of load.
,, ,, voltage.	,, ,, voltage.
,, ,, temperature.	,, ,, temperature.
	,, ,, frequency.
	,, ,, power factor.
	,, ,, balance of load (if polyphase).

Tests should also be made to ascertain the starting current, to see how the meter is affected by external magnetic fields, and, in the case of meters with shunt windings, to see if there is any tendency to run on shunt.

An insulation test and a test for overload capacity may also be desirable, although it will probably be satisfactory to take the maker's guarantee for these.

A thorough test for initial accuracy not only reveals the qualities of the electrical design of the meter, but helps to show up any defects of workmanship causing undue friction.

Accuracy after service will depend on the quality of the materials, the stability of the mechanical design, and the type of meter.

Quality of Materials.—The permanence of the braking magnets is specially important, for if these are not properly aged before calibration, their strength will vary, and the registration of the meter will thus be rendered inaccurate.

The jewels and pivots should be the best obtainable. The jewels should be fixed in settings easily adjustable, and the jewels and pivots should be easily removed.

The insulation of the coils and other live parts should be examined, and any insulating material used should not warp or swell in damp or soften with reasonable rise in temperature.

Spindles and other metal parts should not be liable to rust or corrode.

Stability of Mechanical Design.—The main supporting frame and case should be of material that does not shrink or warp, and it should be sufficiently robust to stand the jarring incurred during transit without upsetting the calibration of the meter.

A clamping device for supporting the rotor independently of the bearings during transit is an advantage.

The holes for the fixing bolts or screws should be large enough to admit a bolt or screw capable of withstanding any strain that is likely to be incurred. This may be considerable in the case of meters of large capacity, owing to the size of the cables which have to be connected to the meter.

Type of Meter.—A rough comparison of the probable durability of the jewels and pivots may be made by noting the speed in revolutions per minute and the weight of the rotor. The meter which has the lightest rotor running at the lowest speed will probably show the least wear on the jewels and pivots. With a mercury meter the rotor floats in the mercury, and the pressure between the pivots and the jewels is, therefore, very slight.

Accuracy after service also depends on the constancy of the retardation due to friction. In alternating-current meters of the induction type this is not likely to vary much, as the rotor is very light and the speed low, so that wear between pivots and jewels is negligible. The same remarks apply still more to continuous-current meters of the mercury motor type.

But in the case of commutator meters, in addition to the greater wear of jewels and pivots, due to heavier rotors and higher speeds, the variation of the friction between the brushes and the commutator may quite change the calibration of the meter.

Finish is deserving of some notice, for this may be in effect a gauge of the quality of the workmanship employed. It should be remembered, however, that "finish," like "charity," may cover "a multitude of sins"; in other words, a well finished meter is not necessarily an accurate one.

Convenience.—This may be considered as referring to handling, fixing, sealing and reading.

Handling.—Heavy meters are not so easily handled as light ones, but a heavy meter with a carrying handle is more easily handled than a light one without a handle.

Fixing.—Three fixing holes are more convenient than two or four, for the meter can be hung by the top screw and levelled up before the other screws are inserted. Room should be allowed for fixing the screws without the use of special tools.

Sealing should be easily effected, and the seal should be in a prominent position, so that any tampering is at once noticed.

Reading.—Clear open dials are the best, and it is preferable to have all the figures in a straight line. They should be easily read, even in a bad light. Dials easily read are an advantage; directly, by enabling the meter readers quickly to take accurate readings, and, indirectly, by making it easy for the consumer to read his meter, and thus overcome the sense of mystery which inspires distrust.

Cost.

The question of cost may also be considered under three sub-divisions—namely, Prime Cost, Running Cost, and Maintenance Cost, and a final decision on the question of cost should only be arrived at after an investigation has been made under each sub-division.

The *Prime Cost* does not require any other remarks than a reminder that the tenders should be carefully read to see whether the makers' offers all agree with the specification as to size, type, &c. Makers are often informed by customers that they are "hopelessly out" in price when in reality the customer is comparing a more expensive with a less expensive size or type.

The *Running Cost* is important, and may determine the type of meter to be used. Thus where the voltage of a continuous-current system is constant within narrow limits, ampere-hour meters can be used with advantage, and the shunt losses which would be incurred with watt-hour meters are thus avoided. On continuous-current systems there are very few cases where the use of watt-hour meters can be shown to be preferable.

Shunt losses should be capitalised, for with many small consumers the energy consumed by the meter is an appreciable percentage of the total energy taken. On the other hand, it should be remembered that shunt losses, being continuous, are supplied at a load factor of 100 per cent., and their cost should be reckoned at a reduced rate to correspond.

Maintenance Cost.—Under this heading may be considered the ease or difficulty experienced in carrying out minor repairs on site or in the customer's test room, and the facilities offered by the maker for the supply of spare parts.

The first of these considerations depends largely on the design of the meter and its suitability for dismantling and reassembling by junior assistance. The maker's method of manufacture affects this question, for parts are more easily interchanged if made by machinery to jig and template than if made by hand.

The second has to do not only with the immediate future but is also affected by the maker's willingness to maintain a stock of spare parts for a reasonable period after the meter has been superseded by a new design.

Commercial Service.

This covers such questions as delivery, the facilities offered by the maker for checking meters supplied by him, guarantees, and last, but not least, courtesy.

Delivery is sometimes the question which decides the placing of an order. Customers are advised to consider not only the promise of the maker but also his past record for keeping to the promises made.

Facilities for Checking Meters on Site.—Some makers send their representatives periodically to large customers to test and adjust in the customers' test rooms meters which cannot be conveniently dealt with by the customers' own meter men. This practice is of great mutual advantage in avoiding delays which would otherwise occur in sending meters back to the maker's works, and in enabling the maker to keep on good terms with his customers.

Guarantees.—To hold a maker to the literal terms of his guarantees may be difficult, but old-established firms who value their goodwill are generally prepared to stand by their goods, even if they do not consider that they are legally bound to do so.

Courtesy.—Lack of courtesy in business dealings, strictly speaking, should not influence the choice of a meter, but human nature must be considered, and unintentional lack of courtesy is often the cause of loss of business. Buyers of meters should remember that polite correspondence will not affect the meter accuracy, and correspondents should remember the wise man's estimate of a "word fitly spoken." Sometimes it is more fitly left unspoken.

The foregoing considerations are here summarised in chart form, and it is hoped that a reference to the chart may occasionally be helpful when tenders are being considered by purchasers of electricity meters:—

The Selection of an Electricity Meter:

Choice should be guided by—

- Quality denoted by
  - Accuracy viz. :—
    - Initial accuracy depending on
      - Electrical design affecting
        - Errors due to variation of
          - Load.
          - Voltage.
          - Temperature.
          - Frequency.
          - Power factor.
          - Balance of load.
        - Starting current.
        - External magnetism.
        - Shunt running.
        - Insulation resistance.
        - Overload capacity.
      - Workmanship affecting
        - Friction.
    - Accuracy after service depending on
      - Durability of materials, jewels, &c.
      - Stability of adjustments, general robustness, &c.
      - Type.
  - Finish.
  - Convenience as regards
    - Handling.
    - Fixing.
    - Sealing.
    - Reading.
- Cost
  - Prime.
  - Running.
  - Maintenance.
- Commercial service
  - Delivery.
  - Facilities for examination and repair on customers' premises.
  - Guarantees.
  - Courtesy.

ELECTRIC SIGNALLING AND CONTROL ON RAILWAYS.

Owing to the absence of the author, Mr. C. M. Jacobs, this paper before the Institution of Electrical Engineers (an abstract of which appeared in our last issue) was read by Mr. J. Sayers.

Col. Pringle, in opening the discussion, said it was not too soon to formulate plans for railway development after the war. He hoped more extended experiments would be made with the three-position signal; it was desirable to use the upper quadrant and orange coloured light. In track circuiting reliability was of the first importance, and if some method for standardising could be devised it would be a good thing. As regarded train control, the Great Western system was excellent. Such a system should obviate the majority of accidents which were due to signalmen and enginemen; it must not be of a type which tended to neglect of observation of the road, and for this reason cab signalling was less favoured, and audible signals with direct action on the brakes were now being tried. A large proportion of accidents was due to misreading the home or starting signals, and if the control only dealt with the distant signals, it only covered half the cases. The effect of the control at distant and stop signals should differ in degree; at the latter it was necessary to bring the train to a standstill, and he felt that it would not in such a case be inadvisable to take the control out of the hands of a driver. He understood that on the Underground and Tube Railways this system had had no ill-effect on the drivers.

Mr. Roger Smith, thought the author's remarks on the position of the ramp in train control systems were rather ambiguous. Neither direct nor alternating current necessarily required the use of a fourth rail in the centre of the track. It was possible that direct-current of moderately high pressure would be used here in future, with the running rails as a return. In such a case, if alternating current was necessary for the track circuit, he asked whether the cab-signalling installation shown in the paper had been adopted yet for the use of alternating current on the ramp. If the national scheme of electric supply, now being considered, were adapted, much more alternating current would be available in the future, and he recommended signal engineers to consider its more extended use. Higher voltages for track circuits could not readily be supplied, except from public mains. At present batteries had to be depended on in country districts. Many thousands of secondary cells were re-charged last year by the Great Western Co., although track circuiting was sparingly used on that line. A light battery, which would remain on open circuit for the longest possible time, was needed.

Mr. Hurst considered that the three-position signal shown left some opportunity for misreading the indications, although this could be avoided by suitable design. It required consideration; in America that type was used in very open country, but in this country it was difficult to arrange signals at junctions to give easy vision. Orange lights had been practically given up by the Clearing House, as it was found to be the worst colour for colour-blindness, and a very large number of men could not see it. He was glad the author rather condemned the use of a common conductor. He (the speaker) had charge of the first automatic signalling on the North-Eastern line, where there was a common wire, and they were always getting false indications. The trouble was avoided by cutting the line into sections, and through complicated junctions by using a single wire for up and for down lines. The use of independent batteries tended to avoid wrong signals through faults, which a central-battery system was open to. Automatic-control apparatus was about the best thing that could be devised, because it could be fitted to any class of locomotive; he thought the Underground Railway train-stop was not so applicable to mineral and goods trains. There was always the difficulty that apparatus in the permanent way might be removed; a mislaid sleeper had knocked off the engine apparatus, and in one case a driver ran 60 miles without knowing that anything was wrong.

Mr. W. J. Thorrowgood said the upper quadrant signal was not universal in America, and only 17 per cent. of the mileage was protected by automatic signals. Daylight varicolour signals were also employed, which were electrically illuminated by the signal apparatus; there were also position-lamp signals employing white lights in different positions; a hood over the lamp shaded it from the sun. Before they swept away our almost universal lower quadrant system, they should consider all the alternatives. Many thousands of signal repeaters were satisfactorily used on the South-Western Railway; he saw no difficulty in using common conductors for signalling purposes under suitable conditions, and mentioned that a common positive conductor had been in use at Clapham Junction for years. He agreed that the shunt resistance usually employed could be very much higher, but considered that a battery pressure of 18 volts for a single-track circuit was rather high; with a 4.5-ohm relay and battery E.M.F. of 1 volt, it was possible with suitable regulating resistance to obtain a maximum shunt resistance day a broader interpretation must be accepted.

Mr. Gott was surprised to hear that such small pressure differences were used in electric track circuits.

Mr. Last said his experience in railway working led to the conclusion that the greater the simplicity, the greater the efficiency. Electric control in all its aspects was too complicated, and it would be disastrous to take away the responsibility of the signalman or driver. The ordinary mechanical signal system was so simple that nothing could go wrong, the only fault being an uncertain indication in hot weather, due to wire stretching.

Mr. Proud pointed out that the paper must not be regarded as suggesting that track circuits were at present unreliable; it had been shown that the 4.5-ohm relay would give the shunt recommended by the author.

NOTES ON WELDING SYSTEMS.

By CAPT. JAMES CALDWELL, M.I.E.E., R.E.

(*Abstract of paper read before the* Institution of Engineers and Shipbuilders in Scotland, *January 22nd*, 1918.)

Welding strictly is the art of uniting parts of similar metal by pressure at a temperature short of the fusing point. To-day a broader interpretation must be accepted.

The very modern extension of the term welding to other than the ferrous metals includes processes which are in the nature of autogenous soldering, and it is very difficult now to draw the line between welding in the old and strict sense of the term and autogenous soldering.

As applied to the ferrous metals, some of the modern processes about to be described involve the addition of metal which is fused into the junction, and would be more strictly described at autogenous soldering than welding. Practically the distinction has disappeared.

Pure Smith Welding.—This, the original method, the only one practical until recently, and then only on wrought iron and steel, consists in heating the parts to a temperature at which they are plastic, bringing together the surfaces to be united, and applying pressure by hammering or equivalent means. It depends upon the fact that clean surfaces of those metals unite under pressure at a correct temperature, and that there is a sufficient range of temperature during which they remain in a welding condition to permit of the necessary manipulation, and that the oxide formed by heating fuses at the welding temperature. The principal points to be observed are that the surfaces to be united shall be clean, the temperature within a certain range, and the hammering so applied as to bring the whole of the surfaces into intimate contact.

The cleanliness of the surface is secured by putting thereon some substance which will fuse, thus protecting the metal from oxidation, and uniting with any oxide formed into a fluid slag or flux, which is expelled under the hammering, leaving the cleaned surfaces free to unite.

In the case of cast iron and certain steels the welding temperature range is much restricted, mainly because the metal becomes damaged, or melts by a comparatively small increase of temperature beyond the minimum required for welding.

Good welding is dependent upon the skill and conscientiousness of the operator, and even a good operator cannot be certain that every weld he makes is a good one. These facts, and the necessity for bringing the parts to be united to the forge fire, restrict smithy welding to comparatively simple shapes, and to articles of comparatively small cross-section.

Resistance Welding is a form of electric welding which is the closest approach to the original smith welding. The surfaces to be united are approximately fitted, brought into close contact, and an electric current passed of sufficient strength to bring the surfaces to welding heat. Then pressure is applied to force them into contact and to extrude oxide, &c., as far as possible. The heat produced by the passage of the current is greater at the contact surfaces than in the solid metal, because the electric resistance, even of well-fitted surfaces, is much greater than that of a similar length of solid metal. The heat is therefore localised by this fact, and is further localised by using clamping electrodes of low resistance, which hold the work as nearly as possible to the weld. Owing to the rapidity of the heating, and the very small amount of air between the opposed surfaces, very little oxidisation can occur.

Butt Welding is applicable to the welding of rods, bars, &c., transverse to the length of the pieces. The pieces to be united are brought together end on, held in proper clamps, the current is switched on, and end pressure applied as soon as the ends are sufficiently heated. The pressure and current are maintained until a distinct burr is formed round the weld, showing that an appreciable amount of plastic flow has taken place, and that there is little likelihood of any oxide which may have been formed remaining in a continuous formation to weaken the weld. This weld is in most cases hammered whilst cooling.

Spot Welding is most commonly adopted in this country to unite sheets or thin plates where a continuous weld or joint is not required. The two sheets are placed between electrode clamps, which press them together; current is then switched on, the surfaces in contact are brought up to welding heat, and the pressure is maintained after current is off until sufficient cooling occurs. The sheets are then moved on to the next spot to be welded, and the operation is repeated. Work so welded is, therefore, united by a line of small welds, and may be compared to flush riveted work. Further developments of this method comprise the uniting of much thicker steel plates, such as constitute the hull of a ship, and experimental work of this nature is now being carried out in America with a view to substituting spot welding for riveting. To make up material displaced under heat and pressure, which might result in perforation with excessive current, snap heads are sometimes applied to the side of the plates, these forming part of the homogeneous weld.

Seam Welding is an extension of spot welding, applicable to comparatively thin sheet work. The electrodes are rollers through which the two sheets are passed, when current is applied and the rollers are revolved. The electric current heats up the sheets to welding point as they pass between the rollers, and they are thus united along the whole of the roller path. This continuous seam joint is stronger than spot welding, is fluid-tight, and the process is comparatively rapid, as it is continuous. The surfaces to be joined must be absolutely clean, either sand-blasted or pickled with acid.

It is common to all resistance welding methods that a comparatively heavy current at a low voltage is required. For this reason alternating current is used, the supply from any available source being stepped down by a transformer, which forms part of the welding apparatus.

Generally, the secondary winding of the transformer consists of a single turn of heavy copper conductor, to the ends of which the clamps or electrodes are secured. In most cases the electrodes are specially cooled by water circulation. This is particularly necessary in butt welding large sections, where the current runs to thousands of amperes, and the welding takes an appreciable time.

Butt welding was first used on a large scale for jointing tramway rails. Among the smaller work for which it is used, the jointing of wire and tubing in manufacture, cable making, and windings of electrical machinery has become very general. The process is also employed in chain making.

The use of both spot and seam welding is most general for comparatively thin sheet articles to be joined by their overlapping surfaces.

Certain pairs of metals can be united by resistance welding, but the welding (or fusion) temperature must overlap or approximate for success.

Fusion Welding.—In the fusion method the edges or surfaces of the pieces to be joined are raised to fusing point. Very generally fused metal is added of composition similar to the work, so that new and old metal are amalgamated to an approximately homogeneous mass. Both flame and electric methods of heating are employed. Fusion welding should properly be classed as autogenous soldering.

Carbon Arc.—Generally known as the Benardos system. The work is connected to the positive lead and the negative electrode is a carbon rod fixed in an insulated holder. An arc is struck by touching the work with the carbon and withdrawing it to a distance varying with the current used.

The pressure required is about 90 volts, and the current from 50 to 500 amperes, according to the size of the work. The carbons vary from ½ in. to 1½ in. in diameter to suit the current. A regulating resistance is used to limit the current, and closer regulation is effected by the worker's control of the length of arc.

The work should be the positive electrode, as that is the hottest part of the arc, and because with the opposite arrangement carbon is carried from the movable electrode to the fixed one, and combines with the fused metal. With the correct connection it is claimed that carbon and other impurities are removed from the iron.

The temperature of the positive electrode of an electric arc is very high. In the case of carbon, it is estimated at about 7,500 deg. F. In other materials it is limited to the vaporisation or boiling point of the metal operated on. It is not necessary to reach such temperatures in welding; the carbon rod is moved along at the rate necessary to obtain good fusion to the necessary depth.

The light and heat from the arc are extremely prejudicial to the unprotected eyes and skin, so that the operator must be well protected.

The Benardos arc is extensively used for filling blowholes in steel castings. The blowhole surface is fused, and metal added and welded up with the original material. Sound work can be secured with due care.

In making butt joints in iron or steel, the parts are abutted, and pieces of scrap of the same material are added and melted to thicken up the joint. Generally this is swaged whilst still at welding heat, the carbon and the swage being used alternately. Lap joints are made in a similar way, metal being added to level off the angle end of the lap.

The carbon arc is used very successfully in the manufacture of steel oil drums, and has been applied during the last 20 years by the Steel Barrel Co. at Uxbridge. For this class of work the carbon arc seems specially suitable, the thickness of the metal generally, and ease with which the side seam can be supported while welding, preventing the burning of holes in the metal.

When tested to destruction by internal pressure the longitudinal weld stretches circumferentially like the original metal. Analysis of the welded metal show that carbon, phosphorus, and manganese are removed from the mild steel, leaving nearly pure iron.

The process requires skill, care, and experience. Swaging and annealing are important items, and for work where these cannot be applied there are better methods available.

The carbon arc has been used on cast iron, using a cast-iron rod as filling material.

The operator should aim at holding the carbon at a distance which gives a quiet, steady arc. With too short an arc the metal boils and spurts. With too long an arc the arc wanders, the heat developed is partly wasted in the air, and there is a liability to oxidisation of the hot metal. The best length of arc depends upon the current used. Therefore, the current needed must be regulated by the resistance in series, and not by varying the length of arc.

It does not appear that carbon arc welding is in general use for other than ferrous metals, although copper can be welded by this process.

The carbon arc is used for cutting and holing, sometimes with a jet of compressed air or oxygen to assist the process. On electric tramways and railways, where current is available from a trolley or third rail, it is a very convenient way of cutting and holing hard steel "special work," which is not amenable to ordinary tools.

Metal Arc.—In the Slavianoff process, the carbon rod is replaced by a rod of metal of similar composition to that to be welded. The arc temperature with a metal electrode is considerably lower than the carbon arc, so there is less risk of burning the work.

In a carbon arc, the material of the positive electrode is carried across the arc in the form of vapour, and deposited on the negative electrode. It may be more or less oxidised by contact with the air during the passage, therefore, if the rod is made the positive pole, metal from it is projected upon the work. In a metal arc, besides this action, molten portions of the smaller electrode are projected bodily across the arc. This seems to occur independently of the polarity with alternating-current as well as continuous arcs. The point does not seem to have been investigated, but it is established that continuous current, with the rod the positive electrode, is better than alternating current, though both are in successful use. The projection effect is sufficiently powerful to overcome gravity, so that welding can be done from below. The result is that the material of the rod is transferred, and forms the filling metal for the joint. Slavianoff introduced this process, and it was found to be superior in some respects to the carbon arc. There is no possibility of carbon being added to the welded metal. Suitable constituents can be added to the rod to obtain the required quality of metal in the weld, matching that of the work.

The bare-metal electrode has, however, some disadvantages. The electrode is necessarily at a red heat for some distance from the arc, and therefore oxidises on the surface, and the transferred metal is more or less oxidised by contact with the air in its passage across the arc. This oxide is liable to get into the weld, forming flaws. The bare metal also dissipates a good deal of heat, thus wasting energy. On the other hand, the arc itself is much shorter than the carbon arc for equal currents, and less energy is radiated from it.

The bare-metal electrode is used considerably in the United States, where some users state that no fluxing is necessary. Other American authorities state that the weld made without fluxing is distinctly cold and short, and requires annealing. There is very little European experience available as to welding with bare-metal electrodes.

Coated-metal Electrodes.—In the gaseous flux process the metal electrode is covered with a fireproof sleeve of non-conducting material, so that as the metal is removed by the arc the sleeve projects beyond the end of the rod, forming a guide for the molten welding metal, the sleeve itself falling away automatically. This sleeve also protects the metal from oxidisation, and reduces heat losses.

It is an improvement on the bare-metal electrode, and a great deal of satisfactory work has been done with it, namely, in repairing marine boilers, stern frames, and other ship parts. It is also successfully used to build up worn parts, such as propeller shafts, worn crank shafts and axles, which are afterwards machined to size.

The patent claims the use of no particular material for the fireproof sleeve, and no other purposes than those mentioned, but the companies exploiting the process claim that it can be made the vehicle of constituents which will give desired characteristics to the added metal.

Liquid Flux Process.—In this process, invented by Stromenger, of the Quasi-Arc Co., a sleeve or covering is applied to the material, and the material of this sleeve is such that it melts and forms a flux covering the end of the electrode and the added metal, thus protecting both from oxidisation. The flux may contain constituents having a chemical action upon the fused metal to improve its qualities. As originally used, the electrode was laid along the line of the weld, connected to one pole of the circuits, and an arc started at one end which travelled along the line, fusing both the work and the electrode metal, and leaving the weld covered with the flux. It was found better, however, to clamp the rod in a holder, moving it by hand along the length of the weld at a suitable rate, and giving it at the same time a swinging movement across the line of weld, as is done in blowpipe welding. The arc is formed entirely within a sheath of molten flux, so that the metal is at no time exposed to oxidisation. The arc is very short, about ⅛ in. as a rule. Incidental advantages of this method include smaller heat losses from the arc, and that work can be done with a lower expenditure of energy than by any other arc methods.

The covering material used generally has asbestos as a basis, which is impregnated with salts, calculated to combine with the asbestos to form a mixed silicate flux or slag of suitable viscosity, and with the property of cleaning the metal surfaces from oxide, &c. The viscosity of the molten slag is of importance. It must be sufficiently fluid to permit the free movement of the rod working in it, and to free itself from the molten metal, but not so fluid that it is blown away from the weld by the gases escaping from the arc. Different makers use different compositions, and it is probable that some variation is desirable to suit different metals.

Some experiments are being made with fluxes of a "basic" character instead of "acid" silicates, presumably to reduce the silicate in the metal.

In some cases the fluxing material is put on the electrode rods in a plastic condition by forcing through dies, and in other makes part of the flux constituents are placed in the form of a powder in a tubular or channel electrode.

The material of the rod can also be varied to suit the work. For example, nickel-plate rods are made for the special purpose of welding high-speed tool steel into mild-steel shanks. Compound rods are made, and an aluminium ribbon or wire is sometimes wrapped round the rod, before the flux coating is applied. Since the fused electrode metal is protected from oxidisation by the flux, it can be so compounded as to give a welding material of any desired composition, which is of considerable importance when the weld has to resist high stresses, or when the added metal has to act as a reinforcement, or has to be machined to form a working part or surface.

There is a great deal of experimental work in process on these lines, and whilst some of the results may have little more than advertising value, others of material importance have already become known.

The fluxed-metal arc process is certainly of the greatest promise for constructional welding, as, for example, in shipbuilding. Trials already made on full scale show that in some respects it is superior to riveting. Actual experience in ships in service is wanted to show whether these last results are borne out in practice, because no testing machine can reproduce the complete stresses endured by a ship in service. There is already good reason to say that if welding can replace riveting, there will be a considerable saving in material and labour in shipbuilding Whether an all-welded ship is practicable or not, this method of welding is satisfactory for a large number of constructional details.

Butt joints must be suitably prepared by veeing and fitting. Plates under ¼ in. thick need not be veed, as complete fusion for this depth can be assured. The angle of the V should be no larger than to permit the end of the electrode to get well down to the lower surface. In thick work it is usual to apply several layers to get full thickness. The slag should be emoved from each layer before another is applied, and the urface brushed bright with a wire brush.

The rod is held at right angles to the face of the work. Care is necessary to maintain the arc at the proper length. f the electrode touches the work it will probably stick. It hould be fed down at the rate at which it melts, or the arc vill break from the great length. Excessive length of arc hort of the breaking point tends to produce porous metal. The rate of feed along the joint should be steady, so as to roduce a layer of even thickness. Interruptions should be voided, and when unavoidable—as in coming to the end of n electrode—the metal should be thinned out for a short listance and thoroughly re-fused.

(*To be concluded.*)

LEGAL.

F. D. Baldock *v.* The City of Westminster Council and the Charing Cross, West End & City Electricity Co., Ltd.—Claim for Damages.

At the Lambeth County Court, on Saturday, before Judge Hodges and a jury, Frank Douglas Baldock, taxicab proprietor, of Kennington, brought an action for damages against the City of Westminster Borough Council and the Charing Cross, West End & City Electricity Co., Ltd. The amount in dispute was agreed upon between the parties at £48 15s., the question for the jury to decide being one of liability only.

Mr. H. Brandon appeared for the plaintiff, Mr. Lort Williams for the Council, and Mr. Barrington Ward for the company.

Mr. Brandon said that on the night of March 20th, 1917, one of plaintiff's drivers was proceeding with a cab down Cockspur Street, Westminster, when he collided with an unlighted refuge in the road. This was soon after eight o'clock at night. It was a very dark night, and was raining. At first the action was brought against the Council, but as the Council had entered into a contract with the company for the lighting of the streets, the latter had been joined as defendants. Where this refuge was situated he should consider one of the most dangerous spots in London. The cab, which had an officer inside, came out of Northumberland Avenue, and passed on the off side of the lavatory in Trafalgar Square. It went into Cockspur Street, where there were two refuges. The first had previously had a light on it, but there was no light on this night, and the cab drove into the standard. There was negligence in not having the refuge lighted either on the part of the Council or their servants, the company. The Council admitted that they were responsible for the maintenance of the standard and the refuge, but were not liable for the lighting of the streets. If the light was out it was their duty to have put up at once a red storm light. A considerable amount of correspondence had passed between the Chief Commissioner of Police and the Home Office and with the Council with regard to the lighting of this particular district, showing that in the opinion of the authorities it was too dark. On the same night shortly before this accident another taxi-driver ran into the same standard with his cab, which was damaged to the extent of £60. At that time there was no light on the refuge. In their defence the company stated that they were going to depend on instructions given under the Defence of the Realm Act that they must keep the lights low, but that did not exonerate them or the Council from leaving unlighted a refuge in a dangerous thoroughfare. He proceeded to read a long correspondence since 1914 between the authorities at Whitehall and the Council as to what had taken place over the lighting of this area.

Mr. Ward objected to the introduction of matters which, he maintained, did not come within a reasonable period of the date of the accident.

Judge Hodges ruled that only evidence could be admitted appertaining to any other accident on that particular day.

Mr. Brandon added that some time after the second accident a red storm light was placed on the standard.

Evidence having been given, plaintiff's case was closed.

Mr. Ward maintained that there was no evidence of negligence on the part of the company. It was a fact that the electric lamp at this place, which was ordinarily lighted, was out of lighting. Under the powers conferred upon the Home Office under the Defence of the Realm Act, they had had to reduce their lighting, and it was a criminal offence to contravene the orders issued from time to time. Plaintiff found that one lamp was out in a time of great national urgency, but that was not evidence of negligence.

Leonard James Beit, assistant surveyor to the Westminster City Council, said he had the supervision of the lighting of the city in his charge under the Defence of the Realm Act. From September, 1914, up to the present time he had been in constant communication with the War Office and the Home Secretary with regard to the street lighting, and he had received various instructions. At one time the lighting varied in different parts, but now it was uniform, this arrangement being adopted in January, 1917, after a conference at the War Office. It was then decided that certain lamps should remain out of lighting altogether. They were experimenting for a long time, and whenever the lights in Westminster had been varied this was carried out according to the instructions of the Government authorities. When they learnt that a lamp had gone out, the lighting company was notified, and they sent their men to put up a red storm lamp. There was a general arrangement between the Council and the company that the latter should do this. The usual procedure was that when a light went out the police called the attention of the company to it.

Wilfred B. Thorpe, distributing engineer to the company, said in September, 1914, after consultation with the Home Office, the War Office and the Police, they had to vary the lighting, the instructions to his company coming direct from the Council. He had had complaints about these lamps in Cockspur Street that they were giving too much light, and they had to reduce it. They had to put metal shields on the lamps, besides painting them outside. The shields shut off the ventilation. In order to keep the lamps in order at night they were lighted between twelve and one o'clock in the daytime to see they were all right. They were again switched on at night, and an hour later the standard man passed up and down the streets on a bicycle to see if any light was out or burning badly. They kept a night staff to attend to any defect that might be reported, and men were sent out to attend to any lamp that had gone out. The first time he was told that this particular lamp in Cockspur Street had gone out was at 11.30 at night, when it was reported to them by the police. By an arrangement between the company and the Council carbons that wore away and had to be automatically renewed were attended to by the company. They had to keep the carbons at a "V"-shaped position, and in normal times the actual pressure kept them in place, but they had to reduce the pressure, and the results were very unsatisfactory. The lamps were never designed for the lower pressure. They could not expect the lamps to burn steadily. He could not explain why this lamp went out at the time of the first accident and was re-lit later, as was stated by the constable, but a lamp might go out through the reduced pressure and re-light later. They could not have avoided or foreseen this lamp going out.

Mr. Brandon: Can you prevent the lights going out on low pressure?

Witness: I cannot prevent any lamp going out.

Mr. W. H. Kingston, your chief engineer, has written stating that if the current is reduced the burning of the lamp is erratic. Do you agree with that?—Yes, up to a certain point.

He added that he received a report at 11.30 that this lamp in Cockspur Street required attention and "danger," in consequence of which a red light was put up.

Judge Hodges, in his summing-up to the jury, said they should take into consideration the present condition of affairs, and that the country was at war. By consent the following questions were submitted to the jury, their replies being annexed:—

Q.: Was the accident due to an inevitable accident caused by the diminution of street lighting?—A.: Yes.

Q.: If it was not an inevitable accident, was it due to any negligent action on the part of the Council?—A.: Yes.

Q.: If so, what was the negligence of the defendants?—A.: Their omission to maintain a light on the refuge.

Q.: Was the accident contributed to by the plaintiff by his own negligence?—A.: No.

Q.: Was the lamp in question on the refuge alight at the time of the accident?—A.: No.

Q.: If not, what caused it to go out?—A.: In our opinion there is no conclusive evidence as to the cause.

His Honour reserved judgment until a point of law, which is to be raised by Mr. Lort Williams, on behalf of the Council, has been argued before him.

Kensington & Knightsbridge Electric Lighting Co., Ltd., *v.* Notting Hill Electric Lighting Co., Ltd.—Judgment.

In the King's Bench Division on Friday last, January 18th, Mr. Justice McCardie gave a judgment of great interest bearing on the Electric Lighting Acts, 1882-1909, and the powers of authorities under Provisional Orders, in the case of the Kensington & Knightsbridge Electric Lighting Co. *v.* the Notting Hill Electric Lighting Co. This case, which came before the Court in the form of a special case, was argued before his Lordship recently, as already reported. The following is an abstract of Mr. Justice McCardie's judgment:—

The points at issue between these companies arise upon an award stated in the form of a special case by Mr. James Swinburne. In this judgment I shall refer to the Kensington Co. as the plaintiffs and to the Notting Hill Co. as the defendants. The primary question in the case is the construction of a short clause in a written agreement between the parties dated October 25th, 1900. That clause (so far as relevant) is as follows: "So long as any of the stock"—*i.e.*, certain debenture stock—"shall be outstanding, each of the two companies shall from time to time take from the joint station all such electrical energy as such company (having regard to its other sources of supply) may require for the purposes of its business in accordance with the provisions of the principal agreement."

Each of the two companies was duly registered under the Companies' Act in or about 1888. The memorandum of each company gives broad and comprehensive trading powers. Each company became possessed of the usual statutory powers of supply. Time went on. It became apparent that, in order to meet the ever-increasing demand in both areas for electrical energy, it would be convenient to the companies if an additional source of supply could be provided. Accordingly, the plaintiffs and defendants entered into an agreement dated July 12th, 1899, called the principal agreement, that both companies should join in promoting a Bill in Parliament for enabling the two companies to establish a generating station outside the statutory area of supply of both companies.

On July 13th, 1899, an Act was passed in order to give effect to the contract. The recitals of the Act appear to contemplate that the supply from the joint station shall be given only to the respective statutory areas of supply of the two companies, and Section 5 of the Act provides (in essence) that the two companies "may respectively distribute the energy in such proportions and manner as the two companies may from time to time determine for the purpose of supply within their respective areas of supply, as for the time being authorised, or for giving effect to any agreement made under the provisions of this Act."

Shortly after the passing of the above Act the companies entered into a further agreement jointly with the trustees of certain debenture stock through the issue of which the new undertaking was to be financed. The agreement is dated October 25th, 1900 Clause 3 of such agreement has already been set out in this judgment The joint station was duly erected at Wood Green.

By their Provisional Order of 1889, the defendants were expressly prohibited from supplying energy or laying down any electric lines or works beyond their area of supply otherwise than under the authority of Parliament, or under a licence granted by the Board of Trade. Adjacent to, but, in fact, outside, the area of supply of the Notting Hill Co. (the defendants) is a district called Kensal Town. To consumers within that district the defendants supplied energy in the year 1909. They *bona-fide*, but erroneously, believed that such consumers were actually within their statutory supply area. But they did not procure such energy either from the joint station or their own generating sources. They obtained it from a wholly separate source, and supplied it at a profit to the Kensal Town consumers. The plaintiffs contend that a breach of contract was thereby committed by the defendants. The arbitrator has held that the contention is well founded, and in respect of such breach he has awarded £189 damages.

The defendants, however, submit that their above-named acts do not constitute a breach of Clause 3 of the agreement of 1900.

Another and still more important point arises upon the special case. On November 25th, 1909, the Electric Lighting Act, 1909, was passed. By Section 6 of that Act the Board of Trade was empowered to grant licences whereby an undertaker could supply electricity to consumers outside his actual statutory area of supply. The licence may embody such powers and duties as are deemed appropriate by the Board of Trade. It is, I think, reasonably clear that the effect of a licence is not to extend an undertaker's statutory area of supply. It will operate only as a valid authority to supply electricity (in specially permitted cases) to consumers outside the statutory area. The actual statutory area with its special features of rights and duties remains untouched. Licences granted by the Board of Trade under Section 6 of the Electric Lighting Act of 1909 are commonly and conveniently known as "fringe orders."

In respect of the above-mentioned supply to Kensal Town consumers in 1909, no fringe order had been granted The defendants, therefore, were acting *ultra vires* in giving the supply. But in the years subsequent to 1909 "fringe orders" were duly granted by the Board of Trade, whereby the defendants were authorised to supply electricity to various consumers in the Kensal Town district. Thereupon they supplied electric energy to such consumers. But they did not obtain it from the joint station, nor did they obtain it from their own generating sources. They procured it from a wholly separate source, and supplied it (at a profit) to such consumers. The plaintiffs contend that a further breach of contract was thereby committed by the defendants. The arbitrator has held that such contention is correct, and in respect of such breach he has awarded £1,661 as damages.

The defendants again submit that such last-named acts do not infringe Clause 3 of the agreement of 1900.

The determination of such matters primarily depends upon the true construction of Clause 3 of the agreement of 1900. The clause is difficult to construe. The word "require" is often of doubtful meaning. Its significance must depend on the context and on the special circumstances of the case.

In the light of the Act of 1899, which authorised the erection of the joint station, and of the general provisions of the principal agreement of July 12th, 1899, I think that the defendants in the present case were, *prima facie*, bound to take from the joint station all the electricity in fact needed for their business beyond the amount which they generated at their own sources of supply.

Mr. Tomlin contended that the word "business" meant (in the circumstances of the case) the supply of electricity to the defined statutory area of the defendants Mr Knox submitted that the word "business" was not so limited, but that the supply of energy under the above-mentioned "fringe orders," and also the supply (though *ultra vires*) by the defendants to Kensal Town in 1909 clearly constituted part of the business of the defendants.

In an ordinary case the phrase "Business of a company" would indicate the totality of the operations carried on by the company for the profits of its shareholders. But the word "undertaking" is more appropriate to the services rendered under statutory authority to a specified area in respect of gas, water, electricity, or the like. In the present case it is, I think, clear that the word "business" cannot bear the usual meaning indicated above. As already stated, the Notting Hill Co. possesses a Memorandum of Association with wide powers. The company may use electricity in any part of this country, or even outside the United Kingdom. It may trade freely in any place. It would also be within the powers of their memorandum for the defendants to secure a Provisional Order for the supply of electricity to York, or Exeter, or Chester. I deem it clear, therefore, that Clause 3 cannot mean that the defendants are bound to take from the joint station all the electricity needed for all the operations which may be lawfully undertaken by the defendant company as a trading corporation in any part of this country or abroad. It is therefore necessary to cut down the *prima facie* meaning of the word "business." What limit, then, is to be placed on the meaning of the word?

Mr. Knox submitted that the word "business" in Clause 3 should be taken as meaning the supply of electricity in their defined statutory area by the defendant company, plus the incidental supply by the defendants under fringe orders which might be granted from time to time by the Board of Trade in view of the convenient propinquity of fringe consumers to the area of supply, and plus also the supply to adjacent consumers, even though no fringe orders had been granted. But the defendants contend that such meaning cannot be yielded to such word in view of the relevant statutory provision in the earlier agreement and the circumstances of the case, and that I must, therefore, limit the meaning to the supply of electricity to the defendants' statutory area. Upon the whole, though with much doubt, and not without regret, I feel that I must accede to this contention of the defendants.

The agreement cannot be construed apart from the General Act of 1899, from which alone its efficacy is derived. Both the agreement of 1899 and that of 1900 depend for their juristic vitality upon the Statute. Nor can the agreement of 1900 be construed apart from the provisions of the earlier agreement of 1899. The two agreements are not ordinary commercial documents. They are special contracts made for a special purpose under the authority of a particular Act of Parliament. The apparent generality of words in such agreements must be limited by the circumstances of the case. The question of *ultra vires* arises in this case. It is a sound rule of law that a document should receive so far as possible such an interpretation as will confine the scope of the bargain to acts which may lawfully be done

Stating his reasons for upholding the contention of the defendants as stated by Mr. Tomlin, his Lordship said: The agreements cannot go beyond that which is permitted by the enabling Statute. Now, if the Joint Act of 1899 be looked at it will be seen that the recitals deal in the clearest manner with the specific areas of the supply of the two companies, and with such areas only.

I am satisfied that Section 3 imposes a clear restriction "on the distribution of energy generated at the joint station." It cannot be distributed save within the respective statutory areas of supply. But the defendants' area of supply was precisely defined by their Provisional Order of 1899. I have already pointed out that a fringe order under Section 6 of the Electric Lighting Act, 1909, does not enlarge the statutory area of supply. It gives a particular and limited privilege in another area. It does no more. The actual wording of the fringe orders in this case supports the view I have just expressed. To my mind, they do not impliedly enlarge the area referred to in Section 5 of the Joint Act of 1899. I therefore think that the defendants were not entitled to employ any part of the joint station energy for the purpose of supplying those who were consumers under fringe orders. It follows that any agreements between parties that energy should be so employed would be contrary to the Joint Act of 1899, and therefore void. An agreement to do an *ultra vires* act is wholly unenforceable.

I hold that the true meaning of the word "business" is the supply of electricity within the statutory area. Even if the word "business" were to be taken as including a supply by the defendants to external consumers under the sanction of a fringe order, I should still feel disabled from awarding damages to the plaintiffs against the defendants for not taking the energy from the joint station. For they were not, in my view, entitled to take it, and I could not give damages for the non-performance of an act which was beyond the powers they possessed. It follows that the award is erroneous in respect to the item of £1,661.

As to Head (B), *i.e.*, the supply by the defendants to external consumers in Kensal Town in 1909, it results, in my opinion, that this part of the award, *i.e.*, for £189 damages, is also erroneous, subject to the subordinate point hereafter mentioned. Such supply was not a part of the business of the defendants within the meaning of Clause 3. Not only would a supply from the joint station for such consumers have been beyond the powers and rights given by the Joint Act of 1899, but the supply was, in fact, in direct contravention of Clause 6 of the defendants' Provisional Order of 1889.

Two other points arise on the award. The first point arises as follows:—One of the consumers in Kensal Town was a Roman Catholic School. It was outside the defendants' statutory area of supply. But the school was adjacent to a church, and connected therewith. The church was within the defendants' area. The defendants conducted their supply to the school. They did not directly carry it themselves to the church. But the school had connected their fittings to the church, and thereby gave it a supply of electricity. Thus a building inside the defendants' area got a supply through a delivery of electricity by the defendants to a building outside the area. The energy supplied by the defendants to the school was not obtained by the defendants from the joint station, but from third persons. Such electricity could, and ought to, have been taken, I think, from the joint station. I see no reason for holding the defendants free from liability in respect of the electricity employed in the Roman Catholic Church. To so hold would offer the defendants a simple method of diminishing their obligation under the agreements of 1899 and 1900.

I cannot end this judgment without pointing out that the award now before me, which is stated in the form of a special case, does not contain any finding of fact save in one or two circumstances mentioned in paragraph 4 thereof. Mr. Swinburne is a most distinguished expert, and not a lawyer. But I feel that it is most desirable, and indeed essential, that every special case, whether stated by a lawyer or a layman, should contain a statement of every relevant fact as found by the arbitrator. In all future special cases I trust that the facts will be stated with clearness and fullness, and that the relevant documents will be specified in such case.

With regard to the costs of this special case, the defendants have succeeded to a large extent. But they have failed on some heads of the award, and several of their unsuccessful contentions occupied a substantial measure of time. Hence, I think that their costs should be taxed, and that they should receive two-thirds only of the total costs allowed.

With regard to the costs before the arbitrator, it suffices to say that he has dealt with them in the award with the exception of the small point arising (and already mentioned in this judgment), as to the supply to the church.

Clones Electric Light & Power Co. v. Commissioners of Valuation.

In the Court of Appeal, Dublin, on 17th inst., before Lord Justice Ronan and Lord Justice Molony, an appeal was heard in which the Commissioners of Valuation appealed from a decision of King's Bench Division on a case stated by County Court Judge Johnston. The Clones Co. had appealed against an assessment of £100 upon the company's lighting and power equipment as being excessive, and the judge had reduced it to £75, apportioning £25 to the buildings, &c., and £50 to the mains, poles, and easements. In the King's Bench the parties agreed to the value being ascertained by reference to profits. The Court, without expressing any opinion as to the propriety or applicability of such principle, affirmed the judgment of the County Court Judge, with costs against the Commissioners. In his judgment Mr. Justice Gibson had expressed disapproval of the valuation adopted by the parties, on which the County Court Judge had been asked to decide. The Court affirmed the decision of the King's Bench Division, and dismissed the appeal with costs. They stated, however, that they were not to be taken as expressing any opinion on the question in Mr. Justice Gibson's judgment as to whether the method of valuation adopted was a correct method or not.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Wages in Central-Station Service.

When I came to "Situations Vacant" in this week's REVIEW, I had to look twice at the date to make sure it was January 18th, 1918, and not January 18th, 1913, printed at the top of the page.

We have thus :—

WALTHAMSTOW.—Switchboard Attendant wanted; wages 56s. 3d. for 56-hour week, rising to 62s., *including* war bonus.

Assuming bonus to be the 20s. + 12½ per cent., this is equivalent to a pre-October, 1917, rate of 30s. per week.

ROCHDALE.—Meter Tester; commencing *salary* £2 5s. per week, *including* bonus.

Assuming as above, this equals a pre-October rate of £1 per week.

WARRINGTON.—Junior Shift Engineer: *salary* £2 15s. per week (including war bonus of 10s. per week).

ERITH.—Shift Engineer; *salary* £130 + 15 per cent. bonus—*i.e.*, 7s. 6d. per week.

TUNBRIDGE WELLS.—Shift Engineer; *wages* 35s. per week + 5s. per week bonus.

With regard to the last three instances, the Askwith award is not being complied with. Why?

With particular regard to the last example, further on we see

TUNBRIDGE WELLS.—Wanted, Engine Driver; wages 35s. per week + bonus (amount not mentioned).

Will it be more than 5s.?

Compare with wages for shift engineer at the same station!

There are others!

In conclusion, a labourer at 7½d. per hour, working 54 hours per week and receiving 20s. bonus + 12½ per cent., earns £157 1s. 3d per annum—a little over £3 per week!

En Avant.

The 12½ per Cent. Bonus.

A state of doubt seems to prevail in regard to the application of Sir G. Askwith's decision.

A consideration of its origin, however, lends a principle of guidance. The decision was given primarily under the Munitions of War Act, 1916, this Act covering all electric supply undertakings which are certified by the M. of M.

The award specifies no restrictions *quâ* locality, so is to be construed as universal throughout the country, in so far as the above undertakings are concerned.

This consideration of the case, of course, excludes undertakings not certified by the M. of M., and not parties to any agreement.

T. W. Cole,
Secretary, Provincial Electric Supply Committee of the United Kingdom.

Moorgate Court, E.C., *January 22nd*, 1918.

[A circular communication to the members of the I.M.E.A. on this subject is reported elsewhere in this issue. Other letters, received too late for inclusion, have been held over.—EDS. ELEC. REV.]

Prof. Walker's Battery Rule.

Having heard that the rest of us will think to-morrow what Manchester thinks to-day, your readers may be interested in the new battery rule by Prof. Miles Walker, of the Manchester School of Technology. Some of them, indeed, may find the matter a very important one; for this rule is founded on a misunderstanding, and Manchester students will certainly lose marks if they use it at examinations outside their own school.

I wrote to the school in October last, pointing out that they were wrong in thinking the old rule could be otherwise stated in this way: "Make pq as nearly as possible equal to rs"; where p is the number of rows in parallel, s the number of cells in series in each row, r the resistance of each cell, and q the external resistance. They had argued that this "is, of course, equivalent to the rule—Make q as nearly as possible equal to rs/p"; and they quite rightly remarked that this latter is identical with Prof. Perry's rule—"Arrange the battery so that its internal resistance shall be as nearly as possible equal to the external resistance" ("Calculus for Engineers," page 52). But I drew attention to the fallacy in the first part of this argument, and clinched the matter by taking the simple example of 26 1-ohm cells and an external resistance of 3 ohms; here the first rule tells us to make $s = 2$, while the second tells us to make $s = 13$, which more than doubles the current.

It was then suggested that I had overlooked the possibility of arranging six of the cells in this way $0\ 0\ 0\ 0\ \genfrac{}{}{0pt}{}{0}{0}$ to suit an external resistance of 4½ ohms, and so on in other cases. But I pointed out that these irregular and inconvenient groups are clearly excluded by Prof. Perry's assumption that the battery resistance is rs/p; for this expression does not represent the battery resistance unless p is an integer; and it will be seen that the same assumption is actually made in the above-quoted argument that I had received from Manchester.

I also showed that the proposed modification of the usual rule will sometimes *prevent* the student from getting the greatest current. Taking, for example, the above case in which the internal and external resistances are each equal to 4½ ohms, we find that the current is $5e/9 = 0{\cdot}555\,e$ (where e is the electromotive force of each cell); but the old rule tells us to put the cells all in series, which gives us the greater current of $6e/10\tfrac{1}{2} = 0{\cdot}571\,e$. However, as I have elsewhere demonstrated (*Mechanical World*, dated April 20th, 1917), Prof. Perry ought to have said, "Make pq as near as possible to rs"; this very short and convenient rule will infallibly indicate the battery (of the usual regular form) that gives the greatest current; but we sometimes get only a small fraction of this current if we use Prof. Perry's rule.

Instead of getting a frank admission that the Manchester teaching has been wrong, I am told that "this discussion must now close until after the conclusion of the war." But the war may last a long time yet, largely because our professors have been so far behind those of Germany; and I therefore hope you will now find space for this letter.

W. F. Dunton.

Newcastle-on-Tyne, *January 21st*, 1918.

Illuminating Engineering.

My previous letter scarcely conveyed, I am afraid, the true cause for my criticism on Mr. Trotter's exceedingly interesting address to the Illuminating Engineering Society.

It related only to his expression, "The eye only is the judge," which to my mind is an unfortunate phrase, although a popularly accepted one in relation to illumination results. It requires, however, for the majority of the public an analysis or extension of thought which is seldom attached to it, and, therefore, misleads them into forgetfulness of the fact that in reality the mind, and not the eye, passes judgment, for the latter is merely a "servant" to carry impressions to the brain, the quality or refinement of which and their consequent approval by the mind is determined solely by the degree to which it (the mind) has been trained on the subject.

A high standard of illumination is assuredly not readily appreciated by the mind at the present day, and speaking as a commercial man who has devoted much enthusiasm to the subject, it is scarcely an exaggeration to affirm that the average man's appreciation at first sight is almost in inverse ratio to the standard of excellence supplied, because the eye or mind can but give verdicts in proportion to the consciousness of its requirements.

For this reason did I regret such an expression coming from Mr. Trotter, more so from him than from a less eminent authority, because it tends to confirm the popular error that the mind can capably express judgment without adequate tuition, and accordingly, to the despair of commercial men, no demand for a higher standard of illumination would be created by the public than has satisfied them for ages past.

We know, for instance, that an installation with a given foot-candle intensity and low diversity factor makes a higher standard for maintaining visual efficiency, than one with a higher average foot-candle intensity and bad diversity factor.

I would ask, however, in how many cases would the former standard be selected by the public when appeal to the eye were made?

In fact, not even a mind educated on the subject could rely upon sense of sight in order to rate the value of a diversity factor, which is, perhaps, of primary importance in at least industrial installations.

I further suggest, from practical experience, that it is an error to suppose that the workman at a machine is so satisfactorily served by a high intensity of illumination immediately at the position of work, as by a lower intensity equally spread over the whole area upon which the eye roams. But the sense of sight would convey to most minds a preference for the former.

Upon such elementary facts Mr. Trotter will doubtless be in agreement with me; but I believe that if, instead of apathetically accepting judgment from the eye by the public, more cause for effect were preached in simple language, commercial men would readily appreciate and quickly demand diffusion and diversity factor owing to their important relation to output, &c., and thereby the chief obstacles to the progress of the illuminating engineering movement would be removed.

Sydney O. Cook.

Glasgow, *January 21st*, 1918.

The Production of Ductile Tungsten.

I trust you will forgive me for trespassing on your space again on the above subject, but it seems to me that the letter in your issue of January 11th, signed by Messrs. Speechly, Mumford, and Craig, calls for a reply. Notwithstanding the remarks of that firm of solicitors, I think my original statement was substantially correct, and that it is proven by the following statement to the effect that "the total production of tungsten wire drawn at Rugby, as evidenced by the production sheets, was 5,835,686 ft." This amount, adopting the calculation of Speechly, Mumford & Craig, was ample for all the lamps made and sold by the B.T.H. Co. The lamps imported from America were small in number (less than 1 per cent. of the B.T.H. Co.'s total sales), and they were entirely special.

However, if it will satisfy Speechly, Mumford & Craig and the amused lamp manufacturers, I will correct my original statement, so as to make it read as follows:—"The British Thomson-Houston Co. were supplying their whole requirements of ductile tungsten for lamp filaments in 1912 by manufacture at their Rugby works from material some of which had been partly treated in America."

After all, it is quite unimportant as to whether the whole requirements of the B.T.H. Co. were made at Rugby in 1912, 1913, or early in 1914, so far as my original letter on the *Daily Telegraph* report of Mr. Johnstone's lecture was concerned. What was material was that the B.T.H. Co. were manufacturing ductile tungsten before the outbreak of war. They had been manufacturing it from tungsten oxide for a long time prior to August 2nd, 1914, and, by the way, they started manufacture from tungsten ore mined within the British Empire, in the beginning of December, 1914.

Before closing this letter and the correspondence, so far as I am concerned, I would like to express my surprise that Speechly, Mumford & Craig should now use in this way information acquired from confidential works records, copies of which they obtained by process of law from the B.T.H. Co. in the case which they mention. These records were secured in an attempt by the defendants to bolster up a plea, which from their own knowledge they were unable to prove, that the B.T.H. Co. had not been working Patent No. 21,513* of 1906, to an adequate extent in this country. Evidently they could not support the plea, for the issue was never tried, and although Mr. Fraser's affidavit may be a public document, the production sheets never became such. It may be of interest to state that the defendants were directed to pay the costs of the B.T.H. Co. on the issue.

The case is still *sub judice*, and the remaining issues decided upon by Mr. Justice Astbury and the Court of Appeal will be reviewed by the House of Lords at an early date.

I need hardly comment on the boastful paragraph at the end of Messrs. Speechly, Mumford & Craig's letter, beyond saying that the British public may take comfort from the fact that at least two concerns in this country are each able to supply the whole of the demand for drawn tungsten filaments.

John Gray.

London, E.C., *January 22nd*, 1918.

Meters on a Changed Frequency.

Many thanks to Mr. T. Urmston for his answer on above. The type of meters now in use are induction meters of the following makes:—Westinghouse, Aron, Siemens, A.E.G., B.T.H. There are about 800 in circuit, the bulk of which are 3-ampere, installed in colliers' houses. There are no power circuits connected. Are the figures given by Mr. Urmston actual tests taken with the 50-period meter on the 40-period circuit?

Query.

Cable Breakdowns.

The Review of September 7th. 1917, contained an article similarly entitled to mine of August 24th—namely, "V.B. Cable Breakdowns in the Tropics."

Mr. Beaver therein, after describing his investigations, of which I was not ignorant by the way, goes on to state that the incorporation of a small proportion of high-grade vulcanised rubber with the bitumen affords "a surprising degree of protection" against the softening process.

Will Mr. Beaver state if cables made in this way have been tried under actual working conditions for any length of time, and, if so, with what results?

I regret that such a long time must elapse between Mr. Beaver's article and my letter, but my address will furnish the reason.

D. M. W. Hutchison.

Kuala Lumpur, F.M.S.,
November 29th, 1917.

BUSINESS NOTES.

"Ceag" Shares for Sale.—The Public Trustee is offering for sale 2,500 preference shares of £1 each, and 22,300 ordinary shares of £1 each, all fully paid, in the "Ceag" Electric Safety Lamp Co., Ltd. Tenders have to be delivered by February 8th.

Electrical Manufacturing in Australia.—The *Board of Trade Journal* states that a firm of engineers at Victoria, which has for some years specialised in the manufacture of pumping plants, has completed arrangements to manufacture electric motors up to 50 h.p., on the A.E.G. models.

The Greaves-Etchells Furnace.—Although this furnace was not introduced until 1916, says the *Sheffield Daily Telegraph*, the number of orders it has secured in Great Britain stands second only in the list of makers. The numerous plants installed in Sheffield and various parts of the country are employed on alloy steels, high-speed steels, carbon steels, and steel castings. The Government of the United States have ordered five of them, of large capacity, for their arsenals and dockyards, whilst other orders have been received from such world-famed concerns as the Halcomb Steel Co., the National Radiator Co., the Singer Manufacturing Co., Ford Motor Co., the Stoddart Union Steel Co., the Primos Chemical Co., and others. That the furnace has a great future in America is now assured. Three of the same type are now on order for armament works in Spain, and one is being supplied to New Zealand, to be employed in producing steel castings from scrap. The furnaces in Sheffield have turned out a considerable tonnage of high-speed steel of satisfactory quality.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LVI. No. 270. January, 1918. This issue contains the following papers:—"Gas-Firing Boilers," by Mr. T. M. Hunter; "Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Gillott; "Electricity Supply in Dublin and the Surrounding Districts," by Mr. W. Tatlow.

"The British Engineering Index and Buyers' Manual for 1918" Compiled by F. J. Turquand. London: E. T. Heron & Co. Price 10s. 6d. net.

"Scientific Papers of the Bureau of Standards." No. 309. A Method for Testing Current Transformers. Washington: Government Printing Office. Price 5 cents.

Charge of Stealing.—Two men, who pleaded guilty to a charge of having stolen from the Clyde Valley Electric Power station at Cambuslang brass fittings to the value of £100, were sent to prison by Sheriff Shennan. Hamilton, for 21 days.

France.—A new company has lately been formed in Paris, with a capital of £80,000 and the title La Société de Forces Motrices de la Garonne, to acquire and extend the carbide manufacturing business of Messrs. J. Cartier & Co. and to establish plant to utilise water power in the generation of electrical energy.

Catalogues and Lists.—Engineering and Arc Lamps, Ltd., Sphere Works, St. Albans.—New six-page illustrated list of a number of specially-designed fittings suitable for use with half-watt lamps. The patterns shown are for works and industrial lighting—interior and exterior. Prices, dimensions, code-words, and other details are tabulated.

Ley's Malleable Castings Co., Ltd., Derby.—Twelve-page booklet entitled "Does Time mean Money to You?" and containing a reprint from the Electrical Review, of September 7th, 1917, of the illustrated description of an "Improved Method of Time Checking" (The Ley-Allin System).

"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W. 18.—Illustrated and priced leaflet of various types of electric flash lamps; also small postal enclosures relating to various accessories.

Liquidations.—McPhail & Simpson, Ltd.—Through the expiry of the lease of the works at Wakefield and the consequent disposal of the business and most of the plant, this company is winding up voluntarily, with Mr. G. E. Levie as liquidator. Meeting of creditors, January 30th, at Finsbury Pavement House, E.C.

Trade Announcement.—The address of the Sheffield branch of the India-Rubber, Gutter-Percha and Telegraph Works Co., Ltd., is now 88-90, Queen Street, Sheffield, instead of 28, Angel Street.

LIGHTING AND POWER NOTES.

Birmingham.—National Electric Supply.—In a recent interview on the proposals of the Coal Conservation Sub-Committee, Mr. R. A. Chattock, the City Electrical Engineer, expressed thorough agreement with the necessity of securing more efficient production of electrical energy, though differences of opinion would arise as to the methods to be employed. The division of the country into 16 areas was open to revision; in the Midland area, embracing Birmingham and the Black Country, it was not easy to obtain suitable facilities in any one place for the large power station required. It might be as economical under some conditions to put up several power stations in a district rather than to have one only; it depended largely on water facilities.

The effect on the charges to consumers of the cost of transmission from large stations into the areas of supply had to be borne in mind, as the saving in economical generation may be lost in transmission over a distance. So far as the Birmingham area was concerned, he did not think it would be possible, owing to lack of natural facilities, to generate at one point, though it could be done at several points. The preliminary investigation of the development possibilities of an area, and the methods to be employed, would involve an enormous amount of work. With only an interim report to go upon, it was impossible to go into details of control and administration; there was no doubt, however, that given compensation for any interference with existing rights, centralisation leading to economical production was to be commended.

Mr. Chattock expressed pleasure that the suggestion to gasify fuel, &c., is made contingent upon the methods adopted being perfected. At the present time great expenditure in this direction would not be justified; and it must not be forgotten that what might be best from a national point of view, might not be to the advantage of the supply industry. In view of the enormous business organisation to handle, perhaps, eight times the coal now required to generate a given quantity of electricity, and to handle by-products, the present business of electric supply might become almost an off-shoot of the larger organisations, with the possible danger that the interests of the supply consumers may be jeopardised by the possible failure of one or more of the other branches.

Blackpool.—In connection with the taking over of the urban district of Bispham, the Parliamentary Committee has instructed the electrical engineer to report on the utilisation of the existing electricity works.

Burnham (Somerset).—Price Increase.—The Electric Supply Co. has informed the U.D.C. that the price of electricity has been increased from 6d. to 7d. per unit.

Callan (Co. Kilkenny).—Fire.—Damage estimated at £3,000 resulted from an outbreak of fire at the electric lighting station, almost the entire building and plant being destroyed.

Continental.—Turkey.—According to a report from Constantinople, great attention is at present being paid to the question of developing and utilising the water-power resources of the country. It is consequently expected that there will be an important demand in the country for turbines and allied plant after the war.

Dublin.—The Port and Dock Board has considered a report from its electrical engineer on the question of the supply of electricity for the use of the Board's appliances. The cost of running the power station was estimated in 1904 at £2,000 per annum; this had now increased to £5,000 per annum, or approximately 2¼d. per unit delivered. The question of thoroughly overhauling the existing plant or installing new, raised the question as to whether the Board should continue to generate its own energy or purchase in bulk. The former would entail a capital expenditure of at least £6,000 within three years, the installation of new plant would cost £14,000 to £16,000, of which about one-half would be for reserve plant. In the event of purchasing energy in bulk from the city supply, the necessary converting plant would cost about £5,000, and the City Corporation should be in a position to give a bulk supply at under 1d. per unit; by adopting this suggestion it would be possible to make a saving of £2,000 a year in running costs and £10,000 in capital expenditure.

If the Board decided to take over the provision of electric power in the reclaimed district, it would be possible to arrange a self-contained system capable of expansion when needed, suitable for the requirements of a commercial district, the energy being purchased in bulk on the cheapest and most advantageous terms.

It was, however, necessary to secure a temporary supply for the tenants of the Board; such supply should be capable of expansion into a permanent one to that district, and be able to deliver energy at a price which would enable the new industries arising to have a fair chance of success, and this he considered could only be reached if the supply could be given for less than 1d. per unit. The general proposition of the supply was, however, narrowed down to the question of crossing the Liffey; this could be done by submarine cables, aerial cables, or by tunnel, alternative methods placed in the order of cost; the first was unreliable for high voltage, while the towers to support the cables would cost approximately £8,000, and a 6½-ft. tunnel about £22,000. Whichever method of crossing the Liffey the Corporation should ultimately adopt, provision should be made for carrying the Board's cables, in addition to those of the Corporation. The matter is to be considered at a special meeting.

The Lord Mayor (Councillor L. O'Neill) held an inquiry into statements made at a recent meeting of the Corporation regarding the collection of electricity accounts, and also investigated the allegation that an official of the Council owed an account of ten years' standing. The books were placed at his Lordship's disposal, and several witnesses were examined, and at the close it was intimated that a report would be made to the Council.

London.—St. Pancras.—Mr. Baynes, the chief electrical engineer, has reported to the Electricity Committee that, having regard to the increasing power load, it is desirable to obtain two Ljungstrom turbines, at a cost of £35,000; it is also necessary to spend the following amounts:—Foundations, £900; switchgear and connections, £1,000; pump house and circulating pipes, also all other pipe work, £5,000. If the foregoing were carried out, the two Browett-Lindley engines could be done away with, and with the present shortage of machinery on the market, probably a fair sum could be got for them. With facilities, the makers could deliver the two proposed new sets in seven or eight months. The present load is over 6,000 kw., but, owing to shortage, they were unable to keep up the full pressure on the mains at maximum load times, otherwise this figure would reach some 6,500 kw., and he anticipated a considerable further increase on this figure. During the 12 months to date, they had generated over 17½ million units, and consumed 37,000 tons of coal. By running the two 3,000-kw. turbines, with the new boilers helping, they could handle all the present load with modern plant, and effect an economy in coal of about 14,000 tons per annum, which would secure a saving of nearly £22,000. He submitted that the installation of this new machinery would be a good commercial proposition, while the reduced coal traffic would be of benefit to the railways. In recommending the installation of the Ljungstrom sets, he found that this type was more economical for their purpose; further, any attempts to put in a 5,000-kw. set would involve considerable expenditure in alterations to buildings, and the provision of a new travelling crane. The Committee is in agreement with the engineer's recommendation, and a deputation is to interview the Ministry of Munitions regarding the completion of the coal-handling plant at King's Road Station.

L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £3,000 by the Bermondsey B.C. for a rotary converter for the electricity department, and £53,000 by the Islington B.C., made up as follows:—5,000-kw. alternator, condenser, and switchgear, £28,000; two water-tube boilers, &c., £14,000; coal-bunkers and conveying plant, £11,000.

A conference of representatives of municipal electricity undertakings was held at Caxton Hall on January 16th, to consider the question of bulk supply in the London area; a further meeting is to be held.

Fulham.—The Electricity Committee reports that the power station load during the week preceding Christmas reached 4,300 kw. as against 3,000 kw. in pre-war days.

For the purpose of dealing automatically with the ash from the boilers at the electricity works, and for conveying coal to the new boiler furnaces, the Committee recommends that a suitable clinker-handling plant and coal conveyor be obtained, also an efficient coal weighing apparatus, at a cost of £1,900.

Monasterevan (Co. Kildare).—Electric lighting has been installed at a cost of £3,000.

Mytholmroyd.—Prov. Order.—The U.D.C. has passed a resolution agreeing that the Halifax Corporation should make application for a provisional order under the Electric Lighting Acts, 1882 and 1909, authorising the Corporation to supply electricity within the whole of the urban district, and consenting to the granting of such order by the B. of T.

Rawtenstall.—Proposed Loan. The T.C. has decided to apply to the L.G.B. for sanction to borrow £7,500 for new plant at the electricity works.

Rotherham. A town's meeting has approved of the proposed promotion of a Parliamentary Bill in the next session of Parliament, which, among other things, provides for the purchase of the electricity undertaking of the Mexbro' and Swinton Tramways Co. and the extension of the Corporation generating station in Rawmarsh Road.

Stroud.—E.L. Powers.—The R.D.C. has decided to oppose an application by Messrs. Edwards & Armstrong to take over the powers of the Gloucestershire Electrical Power Co., formed in 1902, and which never carried out the provisions of its Bill in the Stroud rural area.

Wigan.—Hospital Lighting.—The Sub-Committee of the Board of Guardians appointed to consider the lighting arrangements of the hospital at Billinge, has received a report from Mr. G. S. Corlett, who is of opinion that the only satisfactory method of lighting the hospital by electric light is from a generating plant on the premises. The capital expenditure for the provision of 334 lights would be £1,800, and the working expenses were estimated at £212 10s. per year. It was further estimated that electricity would show a saving of over £500 yearly. The Sub-Committee recommended that application be made to the military authorities for approval of the scheme, and that they be asked to bear one-half of the capital expenditure.

Willesden.—Negotiations are proceeding between the U.D.C. and the North Metropolitan Electric Power Supply Co. for the continuation of bulk supply to the Council after March 31st, 1918. Application is to be renewed to the L.G.B. for permission for the Council to install two new 500-kw. rotary converters, at a cost of £5,400.

Worcester.—At a meeting of the Chamber of Commerce reference was made by Mr. Fairbarn to the proposals of the Coal Conservation Sub-Committee. He was given to understand, he said, that the Stourport proposal for the erection of a power station was rather in anticipation of the scheme which would be considered by Parliament. If the Chamber expressed any opinion he thought they should take the view that these gigantic stations should be owned nationally and not by private undertakings.

Yorkshire Electric Power Co.'s Bill.—A special meeting of the Slaithwaite, Golcar, and Linthwaite Councils has decided to oppose the above Bill. The Barnsley T.C. is recommended to join neighbouring County Boroughs in opposing it. The Clayton U.D.C. has also decided to oppose it, and the Greasborough U.D.C., in view of its pending application for a provisional order for electric lighting, has decided to oppose both the company's Bill and that of the Rotherham Corporation.

The Earby U.D.C. is joining a conference of the urban authorities of Keighley, Skipton and Barnoldswick, with a view to joint opposition to the Yorkshire Bill.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—The Corporation tramway receipts for the nine months of the current tramway year are about £10,000 above the corresponding period of 1916-17.

The members of the local branch of the Amalgamated Association of Tramway and Vehicle Workers have tendered notices to cease work on February 1st, unless their claims are settled. They ask for the payment of a war bonus, in full, as granted by the Committee on Production; the total abolition of fines; the employment of discharged sailors and soldiers in preference to others; the abolition of "the present competitive current bonus system"; recognition of the Society and its officials, and the imposing of a condition that all employés in the department, other than skilled craftsmen, shall be members of the Association. Mr. J. H. Cowell, general manager of the tramways, stated that the full war bonus is already being paid. The "fines" referred to are deductions made when, say, employés are late for duty, causing others to have to do the work; the current bonus is an award for carefulness, and not a competition, and work will be found for any discharged sailors and soldiers, who are fit. All Unions are recognised equally, and the demand that all shall be members of the one Association is a matter for the men, and not the management. There are 300 employés in the department, but it is not known how many belong to the Association.

Halifax.—Proposed reductions of the tramway service, including advanced fares and the discontinuance of the Warley Road route, have raised many protests from citizens and organised traders. The Chamber of Trade asked that the fares should not be increased until Bradford and Huddersfield take similar action. Transfer tickets were abolished as from January 12th, but the other changes were postponed until the Tramways Committee has come to a final decision.

Keighley.—Wages.—The award of the Committee on Production in connection with the recent wages dispute on the tramways, grants to youths under 21 an advance of 7s. 6d. per week above pre-war rates, beginning on the first pay day in January, payable at the rate of 1s. 3d. per day or per shift worked. Having regard to the statutory rules and orders made by the Minister of Munitions in accordance with the Munitions of War (Amendment) Act, 1916, no order is made as to the women's rates. The employés' demand was for the youths and also women to have the same advance on pre-war rates (15s.) as was granted the men in November, and that Sunday labour be paid at the rate of time and a half and all ordinary overtime at the rate of time and a quarter. The Committee on Production has ruled that the claim for Sunday and overtime pay has not been established.

Leeds.—Parcels Service.—The tradesmen in the city have agreed to utilise to the fullest possible extent the new tramway parcels carrying facilities which are to be established. Further steps in the matter were taken by the Tramways Committee last week, and arrangements are being made for receiving stations in the outskirts of the city. The scheme will be in operation in about a month.

The Tramways Committee proposes to abolish some of the stopping places in Boar Lane and Briggate, and to adopt a new queue system.

The Committee has decided to recommend the suspension of the most distant suburban tramway services to Street Lane and Lawnswood. The two districts can be served by way of Moortown or Canal Gardens and West Park respectively, and the idea is to concentrate more cars on busier lines, and also to pull up some rails for use in urgently-needed repairs.

The War Pensions Committee, last week, decided to approach the Tramways Committee in regard to the case of a discharged soldier suffering from sciatica, who had been employed for 13 years in the tramways department, and was promised that his place would be kept open, but who, on return, was told there were no vacancies. The general opinion of the Pensions Committee was that this was a bad example on the part of a Corporation department. The secretary was instructed to prepare a return of ex-Corporation workmen who had been unable to get work on return from the Army.

Liverpool.—Wages.—The Tramways and Electricity Committee has recommended to a Special War Bonus Committee that tramway employés should receive an additional war bonus of 5s. per week for men, and 3s. for women, thus bringing them to an amount equivalent to that of employés of other tramway undertakings in the district. An application from employés in the electric supply department for munitions time-workers' bonus, recently extended to electrical workers by the Committee on Production, has been granted.

London.—L.C.C.—The Highways Committee has submitted to the Council a report dealing with the congestion of tramway traffic at Victoria. It is stated that during the busiest hours of the day the number of cars departing from the Victoria terminus, which is a "dead end," averages about 80 an hour, and the number of passengers boarding and leaving the cars is greater than at any other terminus in London. The Highways Committee proposed, as the best solution of the difficulties, the construction of a loop line *viâ* Gillingham Street and Wilton Road, but neither the Commissioner of Police nor the Westminster City Council will give consent. To partly meet the difficulties in dealing with the traffic, an additional cross-over is to be installed, which will increase the number of cars loading simultaneously from 4 to 6.

The cost of applying the bonus of 12½ per cent. to persons employed on hourly or weekly wages in the electrical branch of the tramway department is estimated at £4,025 in the current financial year and £9,125 in 1918-19.

Southport.—Tramway Purchase.—As the result of negotiations that have been in progress for the past year, the General Purposes Committee of the T.C. has decided to purchase the undertaking of the Southport and Birkdale Tramways Co. for the sum of £35,000, as and from January 1st, 1918, the company making a payment of £1,200 to the Corporation on revenue account, in addition to rent outstanding at the end of 1917. The company agrees that the payment of the purchase money may be deferred at the option of the Corporation until July, 1922, subject to payment of interest at 5 per cent. The company's lease of its lines in Southport would expire in 1922, and those in Birkdale in 1937. The arrangement for deferring the payment of the purchase money is made to avoid the difficulty of raising a loan during the war. The necessary steps are to be taken at once for the transfer of the undertaking.

TELEGRAPH AND TELEPHONE NOTES.

Long-Range Wireless.—In connection with Commander Cresswell's statement regarding the reception at various Australian wireless stations of messages sent out by Nauen and other places in Germany, the *Auckland Weekly News* states that similar messages are received nightly at several of the New Zealand radio stations, especially Awanui, which is probably the best equipped in the Dominion. The distance from Nauen to Awanui is about 12,000 miles. The secret of these remarkable results, which in less troublous times would excite world-wide interest, is said to lie in the De Forest ultra-audion receiver.

United States.—The U.S. Navy high-power wireless station at Pearl Harbour, Hawaiian Islands, was opened recently, and messages were exchanged with Washington, a distance of about 5,000 miles.—*T. and T. Age.*

Wireless Operators' Demand.—It is understood that the Association of Wireless Telegraphists, which has a membership of over 2,000, has presented a demand to the Ministry of Shipping for an immediate increase of 100 per cent. on pre-war rates of wages. The demand has been submitted by the Ministry to the Deck Officers' Panel of the Conciliation Board, but the Association's executive complain that, although their organisation is representative of all the highly skilled wireless operators in the service, no representative of the Association has been invited to take part in the proceedings. The Marconi Wireless Co. have intimated that if a majority of the members express a desire, "recognition" will be extended to the Association.—*Daily Telegraph*.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

February 2nd. Waterworks department. Electrically-driven radial arm crane. See "Official Notices" January 4th.

Adelaide.—February 27th. P.M.G.'s Department. Telephone material. Schedules 479 and 483. See "Official Notices" January 18th.

Glasgow.—The electrical engineer is to obtain offers for two further sets of generating plant for Dalmarnock Works.

Manchester.—January 29th. For supply, &c., at the Stuart Street generating station, of three-phase motors for cooling tower fans for the Electricity Committee. Specifications, &c., from F. E. Hughes, Secretary, Electricity Department.

Warrington.—January 29th. Turbo-alternator foundations for Electricity and Tramways Committee. Borough Electrical Engineer.

CLOSED.

Australia.—The Melbourne Tramways Board has accepted the tender of the Australian General Electric Co., Ltd., at £39,720, for the supply of electric lighting plant and apparatus in the whole of the cars employed on the service.—*Tenders*.

Eastbourne.—The T.C. has accepted the tender of Maden and McKee, Ltd., of Liverpool, for the purchase of 150 kw. of plant at the electricity works, at £160.

R.D.C. Electric cable: G. H. Watkins, £72.

Glasgow.—The City electrical engineer has reported upon his negotiations with the British Westinghouse Co., for the purchase of a second set of turbo-alternators, to the same specification as the set at present being manufactured by them for this department. The Committee has agreed to purchase from the company a second 15,000-kw. set for Dalmarnock, at £110,000.

The Tramways Committee has accepted the following tenders:—

Trolley wire.—Fred. Smith & Co., Ltd.
Armature coils.—P. R. Jackson & Co., Ltd.

Government Contracts.—List of new contracts placed December, 1917:—

War Office.

Chatterton's compound.—General Electric Co., Ltd.
Generating sets.—Coventry Simplex Engines, Ltd.; W. H. Dorman & Co., Ltd.; R. A. Lister & Co., Ltd.

H.M. Office of Works.

Engineering works, Bramley O.W. Stores; extension of generating plant: engine, generators and switchboard, R. Hornsby & Sons, Ltd.; British Thomson-Houston Co., Ltd.; suction plants, H. Simon, Ltd.
New Science Museum, Food Controller: Lift, Waygood-Otis, Ltd.; St. James' Park Ministry of Shipping, electric wiring: Duncan, Watson and Co.

Post Office.

Protective apparatus.—Siemens Bros. & Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Walter's Electrical Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Buzzer indicators.—Creed & Co., Ltd.
Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cords.—London Electric Wire Co. and Smith's, Ltd.; Peel-Conner Telephone Works, Ltd.
Stoneware ducts.—Doulton & Co., Ltd.
Insulators.—J. Macintyre & Co.
Telephone mouthpieces.—Crystalate Manufacturing Co., Ltd.
Cable distribution plugs.—British Insulated and Helsby Cables, Ltd.
Saddles for poles.—A Kenrick & Sons, Ltd.
Pole steps.—Guest, Keen & Nettlefolds, Ltd.
Paraffin wax.—Young's Paraffin Light and Mineral Oil Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.
Flame-proof wire.—C. Macintosh & Co., Ltd.

London.—L.C.C.—The Wotan traction type lamps have been adopted for use on the L.C.C. tramcars, and a contract has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd., to cover the total requirements for the ensuing twelve months. The number of lamps required will be approximately 150,000.

Poplar.—B.C. Ferguson's Superheater, Ltd., £250. Superheater for Stirling boiler at generating station. Amount exclusive of pipe connections, valves, and alterations to existing pipes, estimated to cost an additional £50.

Spain.—The municipal authorities of Pastaria (Province of Guadalajara) recently invited tenders for the concession for the electric lighting of the town during a period of ten years. Only a single offer was received, and was accepted.

Willesden.—U.D.C. Watson, Marsh & Co., £46 10s. for installing electric light for Health Department.

THE 12½ PER CENT. AWARD.

The members of the Incorporated Municipal Electrical Association have received from the hon. secretary, Mr. H. Faraday Proctor, a circular relating to the 12½ per cent. and other bonus awards, and to progress payments on contracts.

With reference to the Award made by the Chief Industrial Commissioner on January 7th, Mr. Proctor has received a communication from Sir George Askwith, showing that the 12½ per cent. bonus has to be paid to all plain time workers employed in the Association's undertakings, whether certified undertakings under the Munitions of War Act or otherwise. Considerable latitude is given as to the application of the Award to those other than plain time workers, and the Council is of opinion that, subject to local circumstances, the 12½ per cent., or some variation of this percentage, will have to be paid generally to other than the time workers, of course always excepting those skilled men who have already received the benefit under the 12½ per cent. Award of December last.

With regard to other bonus awards, the Awards of the Committee on Production are only binding upon the parties to an agreement which was come to between the Engineering Employers' Federation and certain Trade Unions, and other undertakings to which a special extending order is applied by the Ministry of Munitions.

Notwithstanding the fact that such Awards are not compulsory, it has been found expedient in a large number of undertakings to pay bonuses somewhat corresponding with the said Awards, and Mr. Proctor states that it is probably desirable that members should follow the practice in the district in which their undertakings are situated as regards the payment of any bonuses in addition to the 12½ per cent., which is compulsory.

The Council has agreed with the representatives of other associations that no payment in excess of 20s. per week, plus the 12½ per cent. bonus, should be made until the matter has been considered by a conference of the different associations, and urges members to comply with this agreement, with a view to avoiding the setting-up of any precedent in any part of the country which may affect the whole.

Referring to the applicability of the above awards and bonuses, Mr. Proctor draws attention to his circular letter of November 1st, 1917, relating to the payment of engineering assistants, and the recommendation "that, as a first step, the bonus awarded by the Committee on Production should be paid (where this has not already been paid) to all members of the staff," &c.

A Committee of the I.M.E.A. has in a forward state the consideration of the question of standardisation of payments to charge engineers, and hopes that information may be circulated at an early date. In the meantime, attention is drawn to the fact that some of the large engineering firms are paying the 12½ per cent. bonus to members of their staff receiving not more than £250 per annum, and bonuses from 12½ per cent. down to 10 per cent. on salaries up to £500 per annum.

As stated in Sir George Askwith's memorandum, this is a matter for the employers themselves to arrange, payments often being necessary if for no other reason than to maintain the status of officials in relation to those who are working under them.

A letter has been received from the Chief Industrial Commissioner to the effect that the "decision" does not apply to boys and youths (*i.e.*, employés under 18 years of age).

With regard to progress payments on contracts, this matter is receiving the attention of the Model General Conditions of Contracts Committee. As, however, no arrangements have been made, and no definite proposals have, as yet, been put forward, the Council of the I.M.E.A. suggests that no payments be made in respect of progress of works remaining on contractors' premises, unless a suitable *quid pro quo* be arranged.

Protected Rubber Gloves. — The *Revue Générale d'Electricité* describes a rubber glove manufactured by the Duquesne Light Co., of Pittsburg. This glove is composed of a sheet of rubber 1 mm. thick, covered and protected by a second glove of horse-hide. The gloves are tested by means of a device comprising a copper hand filled with water, which is placed in the glove, and an iron tank filled with water, in which the gloved hand is placed. A difference of potential of 10,000 volts is applied between the water in the hand and the water in the tank. Only the gloves which this test shows to be properly insulated are passed.

WAR ITEMS.

Exports to China.—In the "London Gazette" for January 18th there is a further list of persons and bodies in China to whom exports may be consigned.

Coal Shortage in Prague.—Prague and the whole of Bohemia are suffering from a serious coal shortage. The weather is severe, and there is a danger that Prague may be left without gas and electricity.—*Times.*

Danish Industries at a Standstill.—For a month, says a Copenhagen newspaper, Denmark has had no supplies from the Western countries, and her industries are coming to a standstill. More than one-fourth of the skilled workmen of the country are out of work, and from week to week thousands of workmen are added to the number of unemployed.—*Times.*

The Tramways of Leipzig.—The "Times" states that in Leipzig the number of tramway cars fit for service has fallen from 700 before the war to 105. The recent snowstorms put 58 out of service, and neither labour nor materials are available to repair them.

Coal Shortage in Germany.—A Reuter dispatch from Amsterdam, dated January 19th, says:—"Berlin is suffering from an enormous dislocation of traffic owing to the recent severe frost, which followed a heavy downfall of snow. A considerable number of the tramway services came to a standstill on Friday, and the entire motor omnibus traffic is also interrupted. The city underground railways are unable to cope with the passenger traffic. Railway communication to and from Berlin is likewise considerably interrupted, and a majority of the large provincial cities are cut off from rail communication with the interior."

Restricted Exports from America.—The Ministry of Munitions are drawing the attention of their contractors and agents to the consequences of the system of restrictions on export and priority of orders, which the United States Government is bringing into operation for the purposes of the war. The result of such a system is that private firms desiring to secure export to this country from the United States of munitions or materials to be used directly or indirectly in the manufacture of munitions will find it increasingly difficult, if not impossible, to do so except either through, or with the direct assistance of, the Ministry of Munitions or other Government Department concerned.—*Daily Telegraph.*

Life in Petrograd.—The Petrograd correspondent of the *Times*, writing under date January 16th, says:—"The tramways have ceased running since Saturday for want of fuel, and this is a great inconvenience to the population, the tramways being the only means of communication. . . . The electric lighting is uncertain; on some days a full service is given, and on others whole districts are left in the dark. The supply of paraffin, which is used for cooking and lighting, has temporarily ceased owing to the chief depôts being snowed up."

Trading with the Enemy.—The "London Gazette" for January 18th contains further additions to the list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Brazil, Central America, Chile, Iceland and Faroe Islands, Liberia, Morocco, Netherlands, Netherland East Indies, Norway, Spain, and Venezuela.

Coal Famine in Germany.—The "Times" correspondent at Amsterdam says that the *Rheinisch-Westfälische Zeitung* gives prominence to the difficulties in obtaining coal, declaring that everyone is suffering from a great coal famine. Half a column is devoted to explaining why, while Germany has coal, a shortage is inevitable owing to difficulties of railway carriage and paralysis of water transport due to snow and ice. The journal says that the crisis has now reached its climax. The journal, speaking of the situation in South Germany, declares that difficulties are increasing daily, and the "distress there owing to lack of fuel is indescribable."

Exemption Applications.—At Radcliffe (Lancs.) Local Tribunal, an electrical engineer, aged 30, married, claimed exemption on the ground that it was essential in the national interest that his business should be maintained, particularly as the bulk of the work now being done was for works controlled by the Government, the remainder being for the export trade. Conditional exemption was agreed to.

Radcliffe Tribunal has granted conditional exemption to an electric fitter (33, Class A), the only man left capable of doing electrical work, and engaged on extensions, repairs, and maintenance of electrical installations at works, &c.

At Lewes, the Electric Supply Co. applied for renewed exemption for A. J. Cox (32, garrison duty abroad), engine fitter and cable jointer. Captain Selby Ash suggested that the case should be adjourned for the National Service authorities to try and find a substitute. The manager of the works (Mr. H. J. Williams) said that he did not think it would be possible to find a substitute, as the man was doing the work of three separate men at an ordinary station. Mr. Farncombe observed that an efficient substitute would have to be secured before the man was released, and the adjournment was agreed to.

At Ryde, the Isle of Wight Electric Light Co. appealed for P. G. Churchill (22), claimed to be in a certified occupation, and by agreement conditional exemption was conceded.

The West Sussex Appeal Court has dismissed an appeal by the National Service Representative against exemption until February 21st granted to a Brighton electrician (40, B 2), but the Court expressed the opinion that respondent should join the Volunteers.

Before the West Kent Appeal Court, exemption was sought by A. S. May (38, C 2), of Orpington, whose case had been put back for him to obtain work of national importance. He was stated to have become electrical engineer at the Ontario Military Hospital at Orpington, and three months were conceded.

At Folkestone, there was a review of the cases of Messrs. Cripps and Pain, switchboard attendants at the works of the Electricity Co. It was complained that they had not carried out the required number of drills with the Volunteers, Cripps not having put in any, and Pain only 11 out of a minimum of 22. Cripps said that the arrangement of hours, eight hours seven days a week, did not permit him to give the necessary time. Ald. F. Hall, for the company, said that the men were on work of national importance, and in a certified occupation. The staff at the works was very much depleted; 40 had left out of 90, and they must have efficient substitutes. The Tribunal respited the cases until February 10th to give the men an opportunity of fulfilling the Volunteer condition, the alternative being the withdrawal of exemption.

At Hastings, the Tramway Co. appealed for several of their staff. Mr. Webb, an electrical engineer (A 1), the only one in the power house with an electrical training, and left with a depleted staff, was granted conditional exemption. The chief clerk (29, A 1) was allowed four months, with the suggestion that someone should be trained to take his place; the depôt superintendent at Silverhill (39, C 1) was given three months; an overhead linesman (37, B 1) and his assistant (31, C 1), who does the cable jointing work, had conditional exemption renewed; a driver in the power house was granted conditional exemption; a car-body man was allowed a final two months; a brake examiner (23, B 1) received three months final; nine tramcar drivers were given from one to three months final; and three men, each in Class C, engaged at the depôts, were each allowed three months by consent of the Military.

IMPORT TRADE OF AUSTRALIA.

A report on the position of the import trade of Australia in July, 1917, by Mr. G. T. Milne, H.M. Trade Commissioner in the Commonwealth of Australia, has just been issued by the Board of Trade.* It has been prepared in place of the usual annual report by the Commissioner. Extracts are given below of such portions as will interest the electrical and allied trades.

Competition from the United States and Japan.—The strong position achieved by the United States in the Australian market has, of course, been rapidly enhanced by the war situation, but it would be altogether a mistake to disregard the fact that previous to the war that position was, year by year, becoming more assured. The branch of trade in which the effect of United States competition is most severely felt is in that of machinery, one of the most important groups comprised in America's total being electrical machinery.

Soon after the outbreak of war numbers of Japanese merchants sent travellers to study the Australian market, and the Japanese Government supplemented these efforts to increase trade by dispatching Commissioners. Both the official and non-official envoys displayed the greatest activity in securing samples of the goods most in demand, and, although the object in view was officially stated to be the supplying of such articles as were formerly imported from Germany, no opportunity was lost of securing orders for goods of any kind that could be successfully manufactured in Japan.

Japan's purchases from Australia have nevertheless been in excess of her sales, and neither her Government nor her manufacturers and merchants will be likely to relax efforts to balance the account by shipments of manufactured goods.

In common with the metal trades generally, there has naturally been a considerable decline in the value of imports of machinery. On the electrical side, British firms have managed to do a considerable amount of business, notwithstanding the many difficulties by which they are confronted. The elimination of the Allgemeine Elektricitäts Gesellschaft ("A.E.G."), whose competition was of the most formidable kind, has left the American manufacturer as our most serious competitor. Up to the present no electrical machinery of Japanese manufacture has been imported, with the exception of a few small motors. For some years a certain amount of electrical material has been imported from Sweden, notably telephonic apparatus, and, to a less extent, dynamos. A large Swedish concern has been giving greater attention to the Australian market of late, and has made arrangements for endeavouring to secure an increased share of the trade.

With regard to electrical appliances other than machinery, the imports of most of these lines show a falling off, but, while the elimination of German competition has tended to strengthen the hold on the market of American and other competitors, the British position cannot be regarded as having been unsatisfactory during the war period when all circumstances are taken into account. The trade in electroliers and brackets is comparatively unimportant, as many of these are made, or at least assembled, locally. In metal fittings, such as switches and lampholders, Japan has entered the market, but these products are not regarded with much favour, although low in price. In heating and cooking appliances, America holds the leading position, but the imports are small in amount, as some of these outfits are put up locally. The trade in wire-filament lamps is very large, and growing in common with other electrical lines, but no figures are available to indicate the value of the import trade. It is mostly shared by the United Kingdom, United States, and Holland. Although these lamps are manufactured in Japan, they do not appear to be exported to this market at present to any extent. The Customs duty on these lamps amounts to 20 per cent. *ad valorem* if manufactured in the United Kingdom, and to 25 per cent. if from other sources. The intention of the Legislature in conceding preference to goods of British manufacture has, however, in effect been negatived, because the wholesale selling price in Holland of the Dutch lamps, for example, on account of lower wages paid, is considerably lower than the wholesale selling price in the United Kingdom of the British lamp. It has been estimated, therefore, that while the duty on the Dutch lamp works out at from 2¼d. to 2¾d. each, that on the British lamp comes to as much as 4½d. per lamp. On account of this disability, firms offering the British lamp to public bodies when tendering are placed at a disadvantage. Japan has done considerable business in electrical glassware (shades, &c.). In insulated cable and flexible cords, the Japanese makers do not, as yet, hold a strong position, but the quality of the goods submitted is stated to have improved, although it is still inferior to those of British firms.

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* Cd. 8,841. Price 3d.

With regard to insulators, the British position has, for a long time, been unsatisfactory, as in certain types of insulators British prices have been such as could not compete with Continental and Japanese makers. A considerable number of insulators are now being manufactured in Australia, and, where found to be satisfactory, these have a preference in contracts issued by the postal authorities. British manufacturers of electrical material are kept well informed of developments in the industry through their branches and representatives, while the British Electrical and Allied Manufacturers' Association, which has an Overseas Committee in Melbourne, is enabled to watch the trade as a whole.

Demand for Engineering Supplies.—A few remarks should be devoted to probable developments in which engineering supplies will be in demand, and to the representation of engineering firms. As in all new countries, there has been, and is likely to be, in Australia very large expenditure on works of a public, as well as of a private, kind demanding engineering plant and supplies.

Schemes for the extension of railways, the improvement of ports and harbours, water supply and sewerage, irrigation power supply (such as those of a hydro-electrical kind in Tasmania, and the development of the immense brown coal deposits in Victoria), held over owing to the war, will be undertaken, and the source whence these will be financed will determine to a large extent where the orders for plant will be placed. Road-making on a large scale is being recognised as one of the most urgent needs of the country.

The pronounced tendency of the State of Australia to control activities which in some countries are directed by the private capitalist is too well known to be dilated upon here, and there is every presumption that this policy will be continued and extended after the war. In the past, British engineering firms have been represented in Australia to a considerable extent by local firms with engineering experience, although in some cases by firms in which this has been lacking. British engineering firms cannot be reminded too often that, if they wish to supply plant and machinery to Government Departments and public bodies in Australia, it is practically essential that they should be locally represented either by a technical man who devotes his whole time to the interests of his firm, or by one or other of the numerous reputable firms in the country who are familiar with engineering work, and are in touch with the Government Departments. In the latter case, it is a good plan for the home firm to have one of its technical men on the staff of the of the Australian firm

One important matter which should be kept in view is whether a given local firm, which expresses its readiness to undertake the representation of British engineering interests in the whole of Australia, is in reality qualified to do so. Instances could be cited, not only in respect of engineering representation, but in regard to agencies of every kind, where the agent can do justice to the interests of his principal in one or two States only, but in which he has made himself responsible for the whole of Australia. Provision against this kind of thing can only be secured by making the fullest possible investigation; indeed, it may be said that no really large and important agency appointment can, as a rule, be satisfactorily made without a visit to Australia by a partner or superior officer of the home firm or company, except in cases where the Australian firm has a London house, or where one of its partners periodically visits the United Kingdom. If there is one criticism which more than another is directed against British manufacturers in practically every branch of trade, it is the failure on their part to appreciate the value of the Australian market, and their consequent unwillingness to expend the time and money necessary to visit the market. This indifference or neglect has undoubtedly contributed to our loss of trade in some directions, and is in reality an expression of that tendency to rely on the buying houses already referred to.

Co-operative Selling Organisations.—In the re-organisation of the engineering and metal industries forced upon the United Kingdom by the war, it has become apparent that, if United Kingdom manufacturers are to meet successfully the strong competition in the markets of the world which is anticipated after the conclusion of hostilities, there must be a far greater degree of co-operation among the firms in a given branch of industry than there has been in the past, and there is already evidence that this is taking place. So much has been written about standardised and large-scale production, and the elimination of overlapping in production, that it is unnecessary to deal with this question here; it is rather the question of co-operative effort in connection with distribution in overseas markets that demands attention.

The recent formation by certain firms of machine-tool makers in the United Kingdom of a trade association which has in view the prevention of overlapping in production and co-operative selling arrangements in overseas markets will, it is hoped, be followed by other branches of industry. If each of the more important industries in the United Kingdom were organised in such a way that the association representative of that industry would act as a guardian of the interests of its members, and would, through its expert officers, systematically study the markets of the world for their benefit, the result would be of the greatest possible advantage to British trade. Let the officers of these associations pay a visit for a few months to the principal oversea markets, and work in co-operation with the resident British official representative of trade, and they will obtain information of such a kind, and be able to present it to those interested in such a form, as cannot at present either be obtained or presented by the official representative of trade who endeavours to keep himself informed on the whole range of the import trade. In saying this, it is not suggested that the individual manufacturers can afford to relax their efforts, but it must be obvious that a systematic investigation of the kind suggested, undertaken in the interests of an industry as a whole, will be productive of better results to British trade than the isolated and, in some cases, imperfectly conceived efforts of the individual firm.

FORTHCOMING EVENTS.

Physical Society of London.- Friday, January 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Presidential address by Mr. C. V. Boys, F.R.S.

North-East Coast Institution of Engineers and Shipbuilders.—Saturday, January 26th. At Newcastle-on-Tyne. At 6 p.m. Address by the Right Hon. C. Addison, M.P., Minister of Reconstruction.

Royal Institution of Great Britain.—Saturday, January 26th. At 3 p.m. At Albemarle Street, Piccadilly, W. "The Chemical Action of Light" (Lecture II), by Prof. W. J. Pope, F.R.S.

Friday, February 1st. At 5.30 p.m. At Albemarle Street, W. 1. Lecture on "Gravitation and the Principle of Relativity," by Prof. A. S. Edington, F.R.S.

Royal Society of Arts. Monday, January 28th. At 4.30 p.m. At John Street, Adelphi, W.C. 2. Cantor Lecture on "High Temperature Processes and Products," by Mr. C. R. Darling (Lecture II).

Institution of Electrical Engineers.—(Manchester Local Section.)—Tuesday, January 29th. At 7 p.m. At the Engineers' Club. Paper on "Telephone Exchange Transfers and their Organisation," by Mr. F. G. C. Baldwin.

NOTES.

The A.S.E.—It is stated that the membership of the Amalgamated Society of Engineers at the beginning of this year was approximately 272,000. At the end of 1911 it was 121,000.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending February 2nd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Second Lieut. F. Gaywood.

Monday, January 28th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 29th.—Musketry instruction for N.C.O.'s at 5.30. Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, January 30th. No. 1 Company, Knotting, &c., 6.30—8.30. Musketry instruction for N.C.O.'s, at 6.30. Recruits' Drill, 6.30.

Thursday, January 31st.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, February 1st.—Musketry, 5.30—8..

Saturday, February 2nd.—Entrenchments, &c., for the whole corps, 2.45—4.45. Musketry instruction for N.C.O.'s, 4.45.

All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The Alleged Discovery of a Substitute for Copper.—German industrial circles are very much interested in the discovery of a new alloy which, it is said, will replace copper for technical purposes. The new metal is said to have a greater density than copper and lower elongation, while being an excellent conductor of electricity. A certain number of tests have already been made on the alloy, and a representative of the A.E.G. is in negotiation with the inventor with a view to acquiring the patent rights. The A.E.G. will probably grant a licence to a large foundry at Lausanne to manufacture the substitute.

Lack of detailed information forbids us to comment with any approach to conviction on the matter, but we may point out that hitherto experience has indicated that any alloy of two metals may be expected to possess a higher resistivity than one of its constituents. Hence, while it would be reckless to deny the possibility of producing an alloy with high conductivity, we are very sceptical as to the reliability of the inventor's claim in this respect.

Women and Electricity.—When a woman is sulky and

will not speak	Exciter.
If she gets too excited	Controller.
If she talks too long	Interrupter.
If her way of thinking is not yours ...	Converter.
If she is willing to come half way ...	Meter.
If she will come all the way	Receiver.
If she wants to go further	Conductor.
If she would go still further	Dispatcher.
If she wants to be an angel	Transformer.
If you think she is unfaithful	Detector.
If she is unfaithful	Lever.
If she proves your fears are wrong ...	Compensator.
If she wants chocolates	Feeder.
If she sings wrong	Tuner.
If she is a poor cook	Discharger.
If she is wrong	Rectifier.
If she is cold to you	Heater.
If she gossips too much	Regulator.
If she becomes upset	Reverser.

—*Electrical Experimenter.*

The Electrolytic Refinement of Copper.—In the course of his Cantor Lectures on "Progress in the Metallurgy of Copper," reported in the *Journal of the Royal Society of Arts*, Prof. H. C. H. Carpenter gave the following account of the refineries at Raritan, near New York:—The metal arrives from Anaconda averaging from 99·3 to 99·8 per cent. of copper. It contains also about 80 oz. of silver and 0·5 of an ounce of gold per ton. The method of arranging the electrodes in the depositing tanks is that known as the parallel or multiple system, in which all the anodes in one tank are connected to one pole of the circuit, and the cathodes situated between them to the other. Each tank has thirty anodes and thirty cathodes, and there are three thousand tanks in all. In this way each tank constitutes one large anode and one large cathode, and the voltage as measured between any two neighbouring electrodes is the same. The system thus allows of the use of currents at low voltage, and the danger of short-circuiting is lessened. The tanks themselves are arranged in series. They are distributed on a series of descending levels, and the liquor flows from one set to the next by gravity through lead pipes, and is kept in circulation by pumps. The cathodes consist of thin plates of pure copper corresponding in size to the anodes, which are 2 ft. 6 in. × 3 ft. × 2 in. thick. The current density is about 12 amperes per square foot, the voltage is 0·2, and the temperature of the electrolyte 55° C. One anode stays in as long as three cathodes. The latter are allowed to grow until their thickness is $\frac{35}{100}$ in. They are then removed, otherwise nodulising occurs, and this sets up short circuits. The anodes last about one month, and are then taken back to the anode-casting furnace. From the sludge in the tanks are obtained gold, silver, platinum, palladium, selenium, and tellurium.

The electro-deposited copper, whose purity is from 99·95 to 99·98, still requires one more treatment. The metal, in spite of its high degree of purity, is not tough, nor is it in a shape suitable for industrial use. It is, therefore, given a final furnace-refining of the same character as that which preceded the electrolytic refining, and is cast into ingots. When intended for conductivity work the metal is cast into wire-bars of varied shape and size according to requirements. Some of these are 500 lb. in weight, and measure 7 ft. × 4½ in. square. Before casting, samples of copper are taken and drawn down into wire and tested for electrical and mechanical properties. The effect of this final operation is to reduce the purity of the copper, owing to the introduction of oxygen, to about 99·7 to 99·8 per cent.

In connection with certain important changes which were made in the Anaconda works in 1914-1915, the Cottrell process for agglomerating and collecting fine particles contained in gases moving at high velocity has been adopted for the recovery of mineral values from the flue dust passing out of the new roasters.

Above the roaster are installed four Cottrell units in a structure located over the main 25 ft. × 25 ft. flue. The units employed are of the so-called "box" type. Each contains 21 plates 20 ft. high and 24 ft. long, 11¾ in. apart. Each plate is made up of sheets of 20-in. corrugated iron, the axes of the corrugations being horizontal. Corrugated sheets are used in preference to flats on account of their stiffness. Between the plates are hung steel chains ½ in. thick over all. The gas flows upwards from the bottom, and returns to the flue by way of a common down-take, the distribution of the flow being controlled by butterfly dampers on the top of the unit. The voltage between the electrodes is about 50,000, and the total power consumed between 90 and 100 H.P. Somewhere about 800,000 cubic feet of gas per minute, at a temperature of 200° C., pass through the four units, though they were designed for only half this quantity. The dust recovered is about 70 tons per 24 hours from the treatment of 1,500 tons of concentrate. A new plant is soon to be installed, which will follow the present units somewhat closely in design.

At the mine of the Chile Exploration Co., situated at Chuquicamata, electrolytic copper of a high degree of purity is obtained from the ore in only three stages. The plant is designed for a capacity of 10,000 tons of average grade ore per day. The latter is crushed to about ½ in. mesh, and leached with sulphuric acid. The greater part of the chloride is eliminated by treatment in tube mills with metallic copper. The remaining copper is precipitated from solution by electrolysis, and the cathodes are melted into commercial bars. The cuprous chloride formed in the dechloridising drums is worked up into copper, either by smelting or by dissolving the chloride in salt and electrolysing, or by precipitating as cement copper with scrap-iron. In the original plant magnetite anodes were used in the electrolytic process. They proved very brittle, and numerous breakages occurred. A substitute which has proved satisfactory on the whole is duriron, a high silicon-iron alloy. It is not entirely unacted on, but from 15 to 20 times its weight of copper can be deposited before it is corroded away. Duriron anodes have an advantage over magnetite in their mechanical strength, but they have a much higher over-voltage, which is a decided disadvantage, and about 15 per cent. more electrical energy is required for the deposition of the same quantity of copper. The conductivity of the copper produced is from 100·5 to 101 per cent. Matthiessen's standard.

From start to finish the process is one of hydrometallurgy, and pyrometallurgical processes—apart from one alternative method of working up the cuprous chloride—are entirely absent.

Electric Lorries and Petrol Economy.—We learn from New York that President Wilson is taking personal steps to bring about petrol economy without undue disturbance of transport interest, and has agreed that every encouragement shall be given to the continued output of electric lorries both for home trade and export to the United Kingdom. The U.S.A. Aeronautical Department has purchased the rotary engine division of the Long Island City factory of the General Vehicle Co. for £500,000, but the terms of the Government contract expressly protect the electric vehicle departments, and every facility will be provided for their increased production if required. It is understood that the present depletion of transport in the United Kingdom largely accounted for the decision not to interfere with the General Vehicle Co.'s export trade.

Breaking up Engine Foundations.—Quicklime, when wet, develops an enormous expansive force that acts slowly and almost irrisistibly, and has long invited use for mechanical purposes. Successful efforts to utilise this force have been noted in a recent issue of *Rock Products*, which describes its efficient use in breaking up heavy brick masonary. Several 12 ft. by 20 ft. piers, 12 ft. high, were situated between similar foundation piers for engines in operation, and it was necessary to remove them without injuring the machinery. Blasting was therefore inadmissible, and hand-cutting and breaking too slow and expensive. The work was accomplished by drilling 3 in. vertical holes 3 ft. deep and 3 ft. apart in both directions over the entire area of the piers, and filling them within 6 in. of the top with freshed slaked lime, in pieces ½ in. to 1½ in. wide. As soon as the lime was thoroughly wet the tops of the holes were filled with brick drilling well tamped, and in about ten minutes cracks started in every direction, and the entire top of the foundation pier was broken into 3-ft. cubes.—*Journal of the Royal Society of Arts.*

Medals for Motormen.—The Medal of the British Empire for courage has been awarded to Motorman J. F. Sams and Conductress E. Anger, of the Southend-on-Sea Corporation tramways, who remained at their posts during the German air raid on the town on August 12th.

Electricity in Agriculture.—Some interesting experiments in connection with the application of electricity to crop culture are being conducted at Liverpool under the direction of Mr. J. A. Brodie, the city engineer, and Mr. Harold Dickinson, the city electrical engineer. The experiments are being carried out at Calderstones Park, where a small installation has been set up in order to test an area of about an acre. Two patches of land have been placed under observation, one being under electrical treatment and the other left to Nature. Each plot has been planted with similar seed, including oats and barley, and the results are being carefully noted. So far the periodical measurements show that the crops under electrical treatment are progressing more rapidly than the untreated, but the trials are not yet sufficiently advanced to afford definite results.

The Siemens Shares.—In reply to a question, Sir Albert Stanley, President of the Board of Trade, states that the shares in Siemens Brothers & Co., Ltd., vested in the Public Trustee, have been sold to British-born subjects. No company has been formed for the purpose of purchasing the shares. One of the conditions of the sale is that the articles of association should be altered in such a manner as to ensure that the control of the company will in future be vested in British subjects, and the Public Trustee received assurances as to the continuance of the business.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the December meeting of the Association, Mr. Napier Prentice, engineer and secretary to the Suffolk Electricity Supply Co., Ltd., was elected as President in succession to Mr. Porter, and Messrs J. E. Edgecombe, Kingston-upon-Thames, and A. W. Money, Chiswick, were elected as the new members of the General Committee. Mr. Percy Still was re-elected as honorary secretary, and made a statement as to the position of the Association and the work dealt with during the year 1917. The total membership of the Association now numbers 88, representing a total Diesel engine horse-power of 52,451. The new class of "subscribers," which was formed towards the end of the year 1916, now numbered 59, being an increase of 40 during the year. The abnormal increase in the price of all classes of fuel oil and the difficulties of obtaining regular and suitable supplies, due to the conditions brought about by the war, had received the attention of the Committee. The control of tar oil supplies by the Ministry of Munitions, and the system of using licences to sellers and purchasers, led to communications and interviews with the Controller of Mineral Oil Supplies, which had no doubt been productive of amelioration in their position. Having devoted a considerable amount of attention to encouraging the production in this country of suitable tar oils for use as Diesel engine fuel, under the impression that the economical use of such fuel would be in the national interest as well as being beneficial to the industry, the Association felt that their claim to be allowed the comparatively small proportion of tar oil fuel necessary for the continuity of the working of their members' undertakings was entitled to some consideration on the part of the authorities. Their action in this matter had certainly led to a better understanding of the situation by the departments concerned. The action of the Association in taking up the subject of the granting of better terms in regard to the allowance for depreciation of Diesel engines for income-tax assessment had led to a very important concession being made by the Inland Revenue authorities. The rate allowed for this depreciation had now been increased from 5 per cent. to 10 per cent., and this increased allowance would remain in force for three years after the cessation of the war. The standard policy of insurance against breakdown, which had been adopted by the Association some time back had been fully considered, and a new clause had been agreed to providing for reference to a Standing Committee of the Association of any disagreement which might arise in the interpretation of the terms of the policy.

Liverpool Engineering Society.—On Wednesday, January 23rd, Mr. Harold Walker read a paper on "Steam Boilers: their Design and Construction."

The Institute of Metals.—The annual general meeting will be held in London on March 13th and 14th. The Presidential Address will be delivered and several papers read and discussed on March 13th, whilst further papers, including the Fourth Corrosion Report, will be read on March 14th.

Institution of Electrical Engineers.—The arrangements for the second half of the current session include the following items:—February 7th, Kelvin Lecture, by Prof. M. Maclean, on "Kelvin as a Teacher"; February 21st, Dr. C. C. Garrard, on "Switchgear Standardisation"; March 7th, Mr. E. B. Wedmore, on "The Control of Large Amounts of Power"; March 21st, Dr. S. F. Barclay, on "The Mechanical Design and Specification of the Turbo-Alternator Rotor"; April 11th (joint meeting with the Electrical Section of the Royal Society of Medicine), papers on "Medical Electricity," with an exhibition of apparatus; April 25th, Mr. E. C. McKinnon, on "Large Batteries for Power Purposes"; May 9th, discussion on "A British Electrical Proving House," with an introductory paper by Mr. C. Turnbull; May 23rd, "Some Transient Phenomena in Electrical Supply Systems"; May 30th, annual general meeting.

At the meetings of the Local Sections the same subjects will be discussed.

Inquiries.—Detailed information concerning the "Wilson" process of electric welding is asked for.

Munition Workers' Bonuses.—An official announcement issued on Wednesday last stated that the Government had had under consideration questions that had arisen in regard to classes of workmen claiming the bonus to munition workers. After careful consideration of the advice of the Committee on Production, and of the whole position, the War Cabinet had decided to adopt the following as a settlement of claims:—

1. The 12½ per cent. has been given to workmen employed on munition work, and paid as plain-time workers in engineering shops, boiler shops, foundries, shipbuilding and ship repairing establishments, iron and steel trades, electricity generating stations and electrical contracting trades, nut and bolt trade, brass foundries and brass works, bridge building and constructional engineering, hollow-ware trade, spring-making works, hot-stamping works, tube works, and wagon-building works.

2. As from the beginning of the first full pay week which followed January 1st a bonus of 7½ per cent. on their earnings shall be paid to all workmen of 21 years of age and over employed in establishments or trades (other than the iron and steel trades), and engaged on munitions work who are piece workers, or are paid on a premium bonus system or any mixed system of time and piece or any system of payment by results, including men working at augmented time rates fixed in lieu of piece rates, or by reference to results or to output of work.

3. The 7½ per cent. bonus shall be paid as an addition to any other bonus or war advances. No workman shall receive the 7½ per cent. bonus who has already received in some other form some equivalent consideration for the 12½ per cent. bonus. Where payment has been made to workmen pending the general consideration by the Government of the position of men paid by results, the amount shall merge in the 7½ per cent. bonus now authorised.

4. A special conference shall be called of employers and Trade Unions concerned in the iron and steel trades to consider the form in which this bonus shall be applied.

5. Any claims to participate in the 7½ per cent. bonus shall be settled by the Committee on Production.

The 12½ Per Cent. Bonus.—The members of the Committee on Production have been appointed by the Minister of Munitions as a Special Arbitration Tribunal (Section 1 (2) Munitions of War Act, 1917) to deal with differences arising on the 12½ per cent. Order referred to the Tribunal for decision by the Ministry of Munitions.—*Times.*

The Scottish M.E.A.—With a view to safeguarding the interests of the smaller municipal electrical undertakings in connection with future developments, the Scottish Municipal Electrical Association has been formed, with Councillor M'Callum (Greenock) as chairman and Mr. W. C. Bexon (burgh electrical engineer, Kilmarnock) as secretary.

Fatalities.—An inquiry was held on 14th inst., at Blaydon-on-Tyne, into the death of Henry P. Poyzer, aged 17 years, an incline-braker at Blaydon Main Colliery. Herbert White stated that Poyzer and he were resting in the mine on the preceding Friday by keeping hold of a metal pipe containing electric cables, when they received a shock. Poyzer was killed and witness was rendered unconscious. William Blythe, a shifter, said he pulled Poyzer off the pipe, but then fainted, and Edward Richardson said he pulled White off the pipe. W. G. Armstrong, a fore-overman, used artificial respiration upon Poyzer. The jury found that Poyzer had been accidentally killed through having improperly taken hold of a steel conduit pipe containing live electric cables, thereby causing the ends of the cables to come into contact and inflict a severe electric shock.

Appointments Vacant.—Shift engineer (£3 +), for the Borough of South Shields electricity works: shift engineer (45s. +), and engine driver (35s. +), for the Borough of Tunbridge Wells electricity department; wireman for the Wolverhampton Corporation electricity supply department; wireman for the Rochdale Union. See our advertising pages to-day.

Midland Power Station Engineers.—On Thursday, February 7th, at 7.30 p.m., at the White Horse Hotel, Congreve Street, Birmingham, the annual meeting of the Midland Electric Power Supply Engineers' Association will be held. The subjects on the agenda are: Address by Chairman; alteration of name of association; future of association, propaganda, &c., and existing scales of remuneration.

America's Electrical Christmas.—Wide-spread reports indicate the success of the nation-wide "America's Electrical Christmas" campaign, conducted under the general direction of the Society for Electrical Development. Unprecedented sales activity in all parts of the country, particularly by contractor-dealers, resulted in a truly electrical Christmas. All of the advertising and sales efforts were built around the suitability of electrical appliances as holiday gifts. The Christmas shopper this year looked for useful presents, and the advertising by electrical interests directed attention to the electric shop. Moreover, this year, more than ever before, men in the industry took their own advice and gave electrical presents.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The salary of Mr. Ernest Holt, manager of the Ashton-under-Lyne Corporation Tramways, has been advanced £50 per annum to £310.

Mr. Thomas D'Arcy Nassau, engineer and manager to the County of Dorset Electric Supply Co., Ltd. (and to its associated companies, the Swanage Co., Lyme Regis Co., and Blandford Co.), has been released by the directors of the companies for service with the Army, and has been appointed to a Commission in the R.F.C.

The salary of Mr. W. B. Smith, chief assistant engineer in the Greenock Corporation Electricity Department, has been advanced by £75 per annum.

Mr. S. A. Russell has been appointed shift engineer at Stuart Street electricity station, Manchester, at a commencing salary of £220.

Mr. A. L. Lunn, a senior shift engineer, has been appointed turbine house superintendent at Stuart Street, Manchester, at a commencing salary of £275, rising to £300.

Holmfirth U.D.C. has appointed Mr. T. France, of Netherton, as an assistant engineer at the electricity works.

General.—After 25 years' service with the Worthington Pump Co., latterly as their resident director at the Newark-on-Trent works, Mr. F. B. Jack has resigned, to take up an important post at the Sheaf Works of Messrs. Ruston, Proctor & Co., Lincoln. He was entertained by the members of the staff, on Friday, January 18th, at the Holborn Restaurant, and a presentation of a handsome writing bureau, with fittings suitably inscribed, was made by Mr. J. N. Boot, on their behalf. The continuous growth and development of the company was effectively described by Mr. E. W. Husted, in which Mr. Jack had rendered the most loyal and hearty co-operation, and, while general regret was expressed at the severance of such a long association, the best wishes were heartily given for his future success with the company he had joined.

The Technical Education Sub-Committee of the Birmingham Education Committee recommends the appointment of Mr. G. A. Perry as temporary Assistant Workshop Instructor for Electrical Trades Classes at the Municipal Technical School, at £193 per annum, plus £15 war allowance.

Capt. James Caldwell, M.I.E.E., R.E., of Messrs. James E. Caldwell, Glasgow, has recently been appointed Deputy Assistant Director of Materials and Priority at the Admiralty. Originally an officer in the Argyle and Sutherland Highlanders, he was afterwards on the headquarters' instructional staff. Later he was attached to the Royal Engineers to supervise the erection of electrical plant, and was afterwards engaged with the military railways section at the War Office.

We desire to congratulate Mr. G. E. Chadwyck-Healey, one of the proprietors of the *Engineer*, on his appointment by the Admiralty to be vice-chairman of the Shipbuilding Council and Assistant to the Controller.

Roll of Honour.—Temporary Major George Clement Milnes, K.O. Royal Lancaster Regiment (who prior to the war was electrical engineer at Lancaster), gained his Military Cross "for conspicuous gallantry and devotion to duty during a period of several days under heavy shell fire." After standing in water over 24 hours, some of his men showed signs of wavering, whereupon he ran along the entire battalion front, rallied the men, reorganised the line, and did a great deal by his personal example to save what would have become a bad situation.

Lance-Corporal F. Shackleton, Traffic Control Unit, who was on the staff of the Oldham Corporation tramways, has been awarded the Military Medal for bravery in dealing with transports under heavy shell fire.

Lance-Corporal F. E. Wyre, Worcestershire Regiment, who has fallen in action, was with Messrs. Belliss & Morcom, Ltd., Birmingham.

Private B. Holmes, Royal Warwickshire Regiment, who was on the staff of Messrs. Willans & Robinson, Ltd., Rugby, is reported wounded and missing since November 20th last.

Sergeant Wm. Baker, R.E., who has been awarded the D.C.M., was engaged in the telegraph construction department of the Midland Railway Co. at Derby.

Private Walter Church, London Regiment, who has died of wounds received in action, was with Accumulators, Ltd., of Woking.

Private R. C. Whewell, who enlisted in May, 1915, from the Outwood station of the Lancashire Electric Power Co., and who already possesses the Distinguished Conduct and Military Medals, has been recommended for a further honour for gallant conduct.

Private Walter Fell, Northumberland Fusiliers, who was reported missing in December last, and is now a prisoner of war in Germany, was employed at the Halifax electricity works.

Private H. J. Bishop, the Buffs, formerly in the instrument department of the India-Rubber Co., Silvertown, was killed in action in France on November 20th, 1917, aged 19 years.

Sergeant A. Duncan, R.E., who has been mentioned in dispatches, was on the staff of the Harrogate Corporation electricity department.

Sergeant H. R. Eastwood, Duke of Wellington Regiment, who has been awarded the Military Medal for bravery at the Battle of Cambrai, was employed by the Yorkshire Electric Power Co.

The Military Medal has been awarded to Pioneer G. Stewart, Irish Brigade, for devotion to duty in holding the lines of communication under shell fire. Before joining the Army he was employed by Mr. Edward Dewhurst, electrical engineer, Preston.

Private John Helsby, King's (Liverpool) Regiment, wounded and in hospital in Worcestershire, was formerly employed by the B.I. and Helsby Cables, Ltd., Prescot.

Major J. L. Partington, Royal Engineers, who has been mentioned in dispatches, belongs to Norton, Worcestershire. On the declaration of war he returned from South America, where he was an electrical signalling engineer.

The Stafford Gas and Electricity Committee this week presented a gold watch to Corporal Holmes, a Corporation employé, in recognition of the award to him of the Military Medal.

We regret to learn that Sergeant-Major Fernand Delebecque, R.E., has been killed on the French Front. He was a brother of Mr. V. Delebecque, of the Walsall Electrical Co., Ltd. As a lad he was employed in the test-room of the Langdon-Davies Motor Co. He served his conscription in the French Army as Brigadier in the 4th Hussars, and had been in the Royal Engineers for more than 20 years. He was stationed at Mauritius and Gibraltar. At the latter place he was P.M. of the Calpe Lodge of Freemasons and a Past Principal of a Chapter there.

Obituary.—Mr. J. S. Sellon.—We regret to learn of the death, which occurred in London, on Friday last, of Mr. John Scudamore Sellon. The deceased gentleman was 81 years of age. At an early age he joined the business house of Johnson, Matthey & Co., assayers and the refiners to the Bank of England and the Royal Mint, metallurgists, &c., founded by his uncle, Percival Norton Johnson, 1822. He played a prominent part in the researches and industrial developments connected with the platinum and other groups of rarer metals with which the name of his firm is associated. Towards the end of last century he also took an active share, both as to technical discovery and industrial development, in electrical engineering, being associated with Faure, Brush, Swan, Lane-Fox, Volckmar, and others in their early work in lighting and storage. In the early days of his connection with electrical matters, Mr. Sellon was a frequent visitor at the offices of the Electrical Review, where he consulted the editors upon various interesting points.

The death occurred, on January 6th, at Negapatam, India, of Mr. Wm. Fredk. Gillott, loco. electrical engineer to the South Indian Railway Co. He was 40 years of age, and belonged to Sheffield.

Sir J. Wolfe Barry.—We regret to learn of the death, which occurred on Tuesday in London, of Sir John Wolfe Barry, the renowned engineer. His connection with the railway electrification experiments of 1899, between Earl's Court and Kensington, will be within our readers' recollection. His pioneering work in engineering standardisation, and his service on Government Commissions respecting tube railway vibration, London street traffic and other matters, are parts of a life full of public work chiefly connected with engineering. Sir John was for many years chairman of the Eastern and Eastern Extension Telegraph Companies. He was 81 years of age.

NEW COMPANIES REGISTERED.

Adams Bros. (Longton), Ltd. (149,322).—Private company. Registered January 9th. Capital, £1,000 in £1 shares. To take over the business of electrical engineers, merchants, manufacturers of and dealers in electric, magnetic, telegraphic, telephonic, and other appliances formerly carried on by R. Adams, as Adams Bros., at Ford Street, Longton, Stoke-on-Trent. The subscribers (each with one share) are:—A. Brier, 102, Trentham Road, Longton, electrical engineer; T. O. Hayes, 39, Stoke Road, Longton, incorporated accountant. The first directors are to be appointed by the subscribers. Solicitor: S. Hayes, 13, Albion Street, Hanley, Stoke-on-Trent.

Brimington Electric Supply Co., Ltd. (149,377).—Registered January 15th. Capital, £2,000 in £1 shares. To carry on at Brimington and elsewhere in Derby the business of an electric lighting and supply company, &c. The subscribers (each with one share) are:—H. Phipps, Brimington, Chesterfield, gentleman; W. T. G. Burr, Brimington, Chesterfield, gentleman; H. J. Martin, Brimington, Chesterfield, moulder; H. H. Beresford, Cromwell Road, Chesterfield, assistant general manager of Staveley Coal & Iron Co.; C. E. Tissington, Brimington, Chesterfield, electrical engineer; R. Wharton, Brimington, Chesterfield, foreman smith; J. T. Frost, Brimington, Chesterfield, chief accountant clerk. Minimum cash subscription, £100. The first directors are: H. Phipps, H. H. Beresford, C. E. Tissington, and R. Wharton. Solicitors: Jones & Middleton, Chesterfield.

Harlow Remedies, Ltd. (149,406).—Private company. Registered January 18th. Capital, £3,000 in £1 shares (2,000 pref.). To manufacture and deal in medical and hygienic specialities, to establish hydros, and other institutions for the administration of electrical and other treatment, &c. The subscribers (each with one share) are:—W. Harlow Davis, M.D. (of U.S.A.), 2, West Bolton Gardens, S.W. 5; W. C. Goulding, 40, Finsbury Pavement, E.C. 2, solicitor. The first directors are: W. Harlow Davis, M.D., and W. C. Goulding (both permanent). W. Harlow Davis is managing director. Registered office: 2, West Bolton Gardens, S.W. 5.

Multiple Fuses, Ltd. (149,397).—Private company. Registered January 17th. Capital, £1,100 in £1 shares. Electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic, and galvanic apparatus, rubber, rubber substitutes, asbestos, gutta-percha, silk, cotton wool, linen, thread, fibre, flax, hemp, jute, paper, papier maché, canvas, and other fabrics, insulating and other materials, &c. The subscribers (each with one share) are:—E. S. Conradi, 6-8, Rosebery Avenue, E.C., electrical engineer; J. F. Conradi, 6-8, Rosebery Avenue, E.C., electrical engineer. The first directors are: E. S. Conradi and J. F. Conradi. Registered office: 6-8, Rosebery Avenue, E.C. 1.

Nicholson Bros., Ltd. (149,370).—Private company. Registered January 12th. Capital, £10,000 in £1 shares. To take over the business of general, motor, and marine engineers and repairers carried on at Great Grimsby and elsewhere by Nicholson Bros., also to carry on the business of manufacturers of and dealers in, and owners of, electric generating plants, motor-driven hoists, winches, and lifts, complete mobile electric welding plants, aircraft, hangars, garages, sheds, aerodromes, floating workshops, &c. The subscribers (each with one share) are: C. F. Nicholson, 5, Westbourne, Terrace, Great Grimsby, engineer; J. W. Nicholson, St. Clair, Lambert Road, Grimsby. Managing director: C. F. Nicholson. Registered office: "Nibromo" Engineering Works, Roberts Street, Great Grimsby.

Basebe, Sadler & Co., Ltd. (149,362).—Private company. Registered January 11th. Capital, £7,000 in £1 shares. To enter into an agreement with A. C. Basebe and J. Sadler (trading as Basebe, Sadler & Co.), and to carry on the business of electrical and mechanical engineers and contractors, founders, smiths, machinists, tool makers, brass founders, metal workers, boiler makers, &c. The subscribers (each with one share) are:—A. C. Basebe, 106, Bingham Road, Croydon, engineer; J. Sadler, 51, Morland Road, Croydon, engineer. The first directors are: A. C. Basebe and J. Sadler. Registered office: 49, Goschen Buildings, Henrietta Street, W.C. 2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Coatbridge & Airdrie Electric Supply Co., Ltd.—Further charge on the company's property, present and future, including the Coatbridge undertaking and the Airdrie undertaking, and uncalled capital, dated December 20th, 1917 (supplemental to charge of October 17th, 1906, created by the Scottish House-to-House Electricity Co., Ltd. the company's predecessor in title), securing £2,000. Holders: County of London Electric Supply Co., Ltd.

Stothert & Pitt, Ltd. (74,218).—Capital, £250,000 in 150,000 ord. and 100,000 pref. shares of £1 each. Return dated December 5th, 1917, 121,750 ord. and 71,350 pref. shares taken up; £47,350 paid; £145,750 considered as paid. Mortgages and charges: £25,000 first debs. and £30,000 second ditto (the latter issued as part of £50,000 registered).

Allen, West & Co., Ltd. (108,870).—Capital, £30,000 in £1 shares. Return dated December 17th, 1917. 28,472 shares taken up; £28,472 paid. Mortgages and charges: £20,000.

Perfect Burglar Alarm Co., Ltd. (112,522).—Formerly known as "Lichtenfeld Burglar Alarm Co., Ltd." Renamed January 30th, 1915. Capital, £4,000 in 1,000 pref. and 3,000 ord. shares of £1 each. Return dated December 5th, 1917. 230 pref. and 1,710 ord. shares taken up; £1 per share called up on 1,210 ord., and 15s. per share on 230 pref.; £500 considered as paid on 500 ord. Mortgages and charges: Nil. Directors: J. H. R. Bright and E. Maitland (both British by birth), and Sigmund Lichfield (formerly Lichtenfeld), naturalised British, of German origin.

J. B. Saunders & Co., Ltd. (112,037).—Capital, £20,000 in 6,000 "A" and 14,000 "B" shares of £1 each. Return dated December 6th, 1917. 6,000 "A" and 12,000 "B" shares taken up, £18,000 considered as paid. Mortgages and charges: Nil.

Foster Construction Co., Ltd.—Charge on moneys due under certain Government contracts for mine sinkers and steelwork, to secure all moneys due or to become due from the company to London and South-Western Bank, Ltd.

Kalgoorlie Electric Power & Lighting Co., Ltd. (91,219). Capital, £225,000 in 175,000 pref. shares of £1 each, and 100,000 ord shares of 10s. each. Return dated June 7th, 1917 (filed November 13th). 150,000 pref. and 100,000 ord. shares taken up; £3 10s. paid on seven ord. shares; £199,996 10s. considered as paid on the remainder. Mortgages and charges: £61,200.

Halifax & Bermudas Cable Co., Ltd. (28,972).—Capital, £50,000 in £5 shares. Return dated October 11th, 1917. All shares taken up; £50,000 paid. Mortgages and charges: Nil.

Nairobi Electric Power & Lighting Co., Ltd. (87,728).—Capital, £50,000 in £1 shares. Return dated December 26th, 1917. 34,050 shares taken up; £30,050 paid; £4,000 considered as paid. Mortgages and charges: £20,000.

Laing, Wharton, Ltd.—Mortgage debentures dated January 4th, 1918, to secure £700, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Minister of Munitions

Musselburgh and District Electric Light & Traction Co., Ltd.—Memorandum of satisfaction to the extent of £800 on December 14th, 1917, of charges dated 1905-9, securing £90,000, has been filed.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

The report is now issued for the year ended August, 1917. With a view to providing for the essential capital requirements of the company during the next two or three years a favourable arrangement was concluded in March last with Messrs. Higginson & Co., of London, for the sale to Messrs. Lee, Higginson & Co., of Boston, of $1,250,000 five-year 6 per cent. general mortgage convertible gold bonds, for distribution amongst investors in the United States. The proceeds of these bonds were duly received. Further expenditure at Melbourne during the year was £114,756, and at Geelong £4,798. The gross profit from the Melbourne and Geelong undertakings was £151,304, as against £143,315 in the preceding year, an increase of 5½ per cent. After providing for debenture sinking funds, putting £10,000 to reserve, putting £20,000 to reserve on account of income-tax and excess profits duty, &c., and writing off certain sums from bond issue cost, sundry items of plant, &c., 7 per cent. is paid on the preference shares and 10 per cent. on the ordinary, free of British income-tax, leaving £10,672, plus £62,144 brought forward, making £72,817 to be carried forward, subject to any further demands in respect of income-tax and excess profits duty. Notwithstanding the increasing difficulty of obtaining plant and materials, and the rising cost of fuel and labour, the business continues to expand. The number of consumers at Melbourne increased from 27,713 to 32,142; lighting from 23,901 kw. to 27,583 kw.; motors from 20,106 h.p. to 23,718 h.p.; units sold from 23,902,084 to 28,395,000; and the gross profit from £131,673 to £141,114. At Geelong the number of consumers increased from 2,573 to 2,843; lighting from 2,468 kw. to 2,643 kw.; motors decreased from 2,314 h.p. to 2,294 h.p.; and units sold fell from 1,519,944 to 1,505,941; and the gross profit from £11,641 to £10,191. The increase in consumers connected at Melbourne was 16 per cent., in power supply 17 per cent., in total connections 16 per cent., in units sold 19 per cent., and in gross revenue 17 per cent.

Marconi's Wireless Telegraph Co., Ltd.

The company has issued a circular to the shareholders stating that the protracted negotiations, with a view to a settlement being arrived at with the Post Office, in respect of the damages to be paid to the company in consequence of the repudiation on December 30th, 1914, of the Imperial contract, have not resulted in producing such an offer as the directors could feel justified in accepting. The proceedings in the High Courts, under the petition of right, have therefore been resumed, and it is hoped that the case will be heard early in the present sittings. With regard to remuneration for the services rendered by the company, and compensation in respect of the company's wireless stations, after their having performed invaluable services for three years, occasioning substantial disbursements, an offer was submitted on August 8th last to the company to cover both remuneration and compensation which the directors could only regard as inadequate and unreasonable. Before the end of last summer the company were given to understand that a new offer was about to be submitted. None has, however, yet been received, and the company are informed that it cannot be made pending the advice of the Law Officers. Without taking into account, however, the considerable sums which are estimated to be due to the company from the Government, the business of the past year has been satisfactory, and the directors feel justified in declaring the 7 per cent. preferential dividend upon the cumulative participating preference shares, and an interim dividend of 5 per cent. on the ordinary shares.

Adelaide Electric Supply Co., Ltd.

The report for the year ended August, 1917, shows that £40,628 was spent on capital account. The gross revenue amounted to £154,451, an increase of 13 per cent. After paying expenses, providing for debenture stock service fund, allocating £5,000 to reserve on account of income-tax and excess profits duty, 6 per cent. is paid on the preference and 12 per cent. on the ordinary shares, free of British income-tax, and £1,640 remains, plus £9,161 brought forward, leaving £10,800 to be carried forward subject to any further demands in respect of income-tax and excess profits duty. The number of consumers increased from 17,732 to 19,590; lighting from 13,360 kw. to 14,420 kw.; motors from 9,287 h.p. to 10,221 h.p.; total connections from 22,647 kw. to 24,641 kw.; and units sold from 8,388,345 to 9,330,495. The consumers increased by 10 per cent., power supply by 10 per cent., total connections by 9 per cent., total units sold by 11 per cent., and the gross revenue by 13 per cent.

The Siemens and Schuckert Companies.

The annual reports of the directors of this group of companies for the year 1916-17 are extremely brief. That of the Siemens-Schuckert Works refers to the increased requirements manifested by the Army and Navy, and the growing importance of the electrical transmission of power. The substitutes introduced for raw materials, which are scarce, were further improved, and the production was developed. In this connection it is stated that the use of aluminium in place of copper will continue after the war, and substantially influence the necessity for obtaining copper from America. The company's dividend, as previously reported, is 10 per cent., as in each of the two preceding years. In the case of the Siemens & Halske Co., the directors report that the works were chiefly engaged on electrical work for the Army and Navy, directly and indirectly, although the electrode and benzine motor works were also very active. The demand exceeded the company's capacity, and the orders on hand showed a considerable increase. The report further mentions that difficulties of working exist, and also in connection with the supply of necessaries to the workers. As recently announced, the dividend is 12 per cent., as in the previous year. The report of the Elektrizitats Gesellschaft (late Schuckert), of Nuremberg, states that the company's forces were fully occupied with preparations for activity after the war, special mention being made of the Bavarian water-power community, to which reference was made in this journal a few weeks ago. The net profits of £375,000, as compared with £403,000 in 1915-16, permit of the payment of a dividend of 8 per cent., as in the previous 12 months.

Yorkshire Electric Power Co.—This company has prepared a Bill for Parliamentary sanction to make further provisions with respect to the supply of electrical energy. The preamble, according to the *Financial Times*, states that since the company was incorporated in 1901 powers have from time to time been conferred upon local authorities to supply electrical energy within the company's area of supply, but outside the jurisdiction of such authorities, and it would be of public advantage that the generation of electrical energy should be concentrated. The Bill therefore proposes to enact that "if any local authority, company, body or person become empowered after January 1st, 1918, to supply electrical energy in any district within the area of supply of the company such undertakers shall take from the company all the electrical energy required by them for distribution." The terms and conditions are to be agreed, or failing agreement are to be determined by the Board of Trade. Provision is also made in the Bill for the constitution of joint committees and joint boards for the exercise "of all or any of the powers of the company and of any local authority" with reference to the generation and supply of electrical energy.

Anglo-American Telegraph Co., Ltd.—Balance dividends of £1 10s. per cent. upon the ordinary consolidated stock, and of £1 10s. per cent. upon the preferred stock, both less tax at 5s., and a first and final dividend of £1 10s. per cent. upon the deferred stock, less tax at 5s. With those already paid, the dividends will thus amount to £3 15s. per cent. upon the ordinary consolidated stock, 6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock for the year 1917.

Gandy Belt Manufacturing Co., Ltd.—The directors are capitalising part of the reserve fund, and are distributing 57,500 new ordinary shares of £1 each in the proportion of one share for every two held. The preference dividend is to be increased from 5½ per cent. to 6 per cent.

Sao Paulo Tramway, Light & Power Co.—Dividend of 2½ per cent. on the common stock

Companies Struck off the Register.—The following have been struck off the register and are dissolved:—

Acton Battery Co., Ltd.
Electrical Sales Promotion, Ltd.
London Battery & Manufacturing Co., Ltd.
[illegible] Electrical & Chemical Culture, Ltd.
Photo-Telegraph & Cable Co., Ltd.
Scandinavian Water Power & Paper Mills, Ltd.
United Cablegram Co. of France, Ltd.

The following will be struck off within three months unless cause is shown to the contrary:—

Bleichert's Aerial Transporters, Ltd.
British Graetzin Light, Ltd.
Eclipse Electric Sign Co., Ltd.
Electrical Works ([illegible]), Ltd.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—According to the *Financial Times*, the accounts for the year ended September 30th last show a loss of £1,731, which reduces the credit balance to be carried forward to £3,825.

STOCKS AND SHARES.

Tuesday Evening.

Business in the Stock Exchange has fallen away a good deal. Amongst the principal causes for the decline in animation are the excellent success of the Tank campaign, the news from Russia, the uncertainty surrounding affairs in Mexico, and a general inclination on the part of the public to keep money back until the next taxation proposals are unfolded. The truly perplexing condition of affairs in Russia is well likened to a vast cinematograph performance in the hands of inexperienced operators, and the latest move on the part of the Bolsheviks in attempting to commandeer British-owned mines in the north of Russia is a new cause for apprehension to those who have money invested in the industrial companies working in Petrograd and Moscow under the control of British hands. It may be recalled that some time ago there was a sensational rise in the price of certain Russian shares on account of a contract secured by one of the companies for the electric lighting in Petrograd, and, although this is now a matter of history, the latest developments in that chaotic country are enough to give rise to uneasiness amongst the British holders of shares in Russian companies.

The Metropolitan Railway Co. is due to declare its dividend this week, and the announcement should be out before the current issue of this journal. There had been a glimmer of hope that, under pressure of popular opinion, the home railway companies might increase their dividends in respect of the last half-year, and, although the Tube companies are not State-controlled in the same manner as the big trunk lines, anticipation was disposed to look for the Undergrounds to make an effort to fall into line with the rest if the latter raised their distributions. There is, however, little hope now that this course will be followed, and the Stock Exchange market looks for a repetition of the 1 per cent. on Metropolitan Consolidated stock paid a year ago, with the usual 2¾ per cent. on the Surplus Lands stock. The price of Surplus Lands stands at 47, which makes the yield, at 2¾ per cent., allowing for accrued dividend, 6 per cent. on the money, comparing with the 4½ per cent. afforded by the Consolidated stock, so that the former is decidedly the cheaper of the two, and only its lack of negotiability prevents it standing higher than the Ordinary stock does. The Underground group will declare their dividends on February 7th. The District Co. has paid nothing since August, 1882, 35½ years ago. The Income Bonds of the Underground Co. are expected to get 4 per cent., which is, of course, paid free of tax, and nothing is looked for on either class of the shares.

Mexicans have been checked in their upward movements by the usual cause which has brought them down after previous rises, namely, that definite information is lacking to support the rumours and hopes raised at the beginning of the year with reference to the re-establishment of normal conditions in the country. Nor is there much enterprise or speculation afoot to encourage optimism with regard to Mexico or anything else, and, although the prices of the various Utility bonds are maintained at their previous levels, it is not so easy to sell now as it was two or three weeks ago. The weakness of Canadian industrials, including those of the light and power companies, is still in evidence, and rumour has it that in some cases, where the concerns have accepted large munition contracts for Russia, difficulties have arisen in regard to their getting paid.

Brazilian Tractions have gone back to 46, a fall of a point, but the Anglo-Argentine group remains steady, and amongst other foreign issues there is no special feature outstanding. Shares of the Hydro-Electric Co. of Tasmania have come into new prominence, and on Monday touched the highest price so far attained during the present boomlet in the shares. After reaching 13s. 9d., the price eased off a little to 13s. 3d., having run up just lately from 8s. 6d., to which it reacted after the previous rise to 12s. 9d., the same reasons being operative in the present bout of buying as those with which we dealt when the shares first began their sensational ascent.

The electricity supply list is quietly firm. Attention is once more being called to the market, in various directions, as offering a good field for investment for money that looks for a 6 per cent. return with a reasonable degree of safety. The War Bonds campaign, however, is certainly telling on this department, as on other parts of the Stock Exchange, and we find a decided disposition, on the part of people with money, to put it into the War Bonds, and to take the 5¼ per cent. which these offer. Both the Adelaide and Melbourne Supply Companies announce excellent results and dividends for the year just ended.

Deductions of the dividends from several of the shares in the Eastern Telegraph group have made comparatively little difference in prices. Globe Ordinary are ⅛ better at 14⅛. Indo-Europeans reacted £1 to 51½, and Anglo-American Preferred is ½ lower at 94½, the market in this stock having been a dull one for some time past. Manufacturing shares are good, with rises of ¼ in Callenders and of ⅛ in India-Rubber shares. The iron and steel market is a little easier, Babcocks receding to 3¼. Chemical shares are firm throughout, more particularly those in companies dealing with soda and the like. There is no change in Castner-Kellners at 3 5/16. The rubber market is dull and heavy, several disappointing dividends conspiring with a further reduction in the price of raw material to bring about a weak tendency in prices. The base-metal markets, however, are hard, more particularly for the shares in companies concerned with lead, tin, and zinc. Armaments exhibit a dullish tendency, although ammunition shares are better on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price Jan. 22, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	8⅝	—	6 18 4
Chelsea	4	3	2¾	—	5 9 1
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11	—	6 7 3
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	3	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3¾	—	5 6 8
Metropolitan	3	3	3¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅝	—	5 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94½	— ½	6 7 0
do. Def.	33/6	1½	23⅜	—	6 8 4
Chile Telephone	8	8	7⅛xd	—	5 12 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15xd	—	*5 6 0
Eastern Tel. Ord.	8	8	150½xd	—	*5 6 4
Globe Tel. and T. Ord.	7	7	14⅛	+ ⅛	*4 19 1
do. Pref. ..	6	6	10⅛	—	6 17 1
Great Northern Tel.	22	24	36	—	6 11 8
Indo-European	18	18	51½	−1	6 6 8
Marconi	10	15	3⅛	—	4 16 1
Oriental Telephone Ord. ..	10	10	3⅛	—	3 4 0
United R. Plate Tel.	8	8	6⅞	—	*5 16 6
West India and Pan.	6d.	6d.	1 7/16	—	*3 9 6
Western Telegraph	7	8	15¼	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	23½	—	4 5 1
do. District	Nil	Nil	15⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	82	—	*4 17 7
Foreign Trams, &c.	Dividend 1915.	Dividend 1916			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2 1/16	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	46	—	—
Bombay Electric Pref.	6	6	9⅜	—	6 4
British Columbia Elec. Rly. Pfce.	5	5	43	—	11 12 4
do. do. Preferred	Nil	Nil	28½	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	58	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	34½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	37	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	— 1/16	4 12 4
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	3⅛	—	6 8 2
British Westinghouse Pref. ..	7½	7½	2⅝	—	5 14 4
Callenders	20	20	14¾	+ ¼	6 16 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 5/16	—	6 1 3
Edison Swan, fully paid ..	—	—	2⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅛	—	6 13 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19	—	5 5 3
Henley	25	25	16½	—	7 11 6
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14¾	+ ⅛	*6 15 7
Telegraph Con.	20	20	42	—	*5 14 3

* Dividends paid free of income-tax.

INDUSTRIAL RESEARCH.

By G. BASIL BARHAM.

Electrical engineers generally are convinced that the commercial position of Britain after the war will depend to a great extent on the energy with which she takes up the work of industrial research. It seems certain that the electrical and, indeed, the engineering supremacy of the future will belong to that country which conducts such work vigorously and in a well organised manner, improves the products of its workshops by the knowledge thus gained, and maintains its lead over all competitors by the simple means of continually improving the quality, increasing the quantity, and bettering the efficiency of its electrical and other manufactures.

Good work will undoubtedly be done by the Department for Scientific and Industrial Research, but its efforts will be insufficient to enable this country to keep the lead in electrical matters unless it is backed up by every firm, both large and small, that is engaged in the industry. The proposal is that Research Associations should be formed in various districts, but as the proposal stands at present provision is made for only science, capital, and manufacturer to be represented. But in such a matter success is not possible unless Labour is also included, and by that is meant unskilled as well as skilled labour. Further, the co-operation of shipbuilders, colliery owners, and manufacturers generally is necessary, and the efforts of any Association, no matter how strong it may seem on paper, are doomed to failure unless research laboratories, as completely equipped as possible, are fitted up wherever manufacturing work is carried out on a fairly extensive scale. It is further necessary that representatives of the electrical industry should have access to these, and should assist in the work carried on, in order to determine to what extent electricity can be of assistance either for driving, electrolytic or thermo-electric purposes.

In the United States it is now the custom in the materials testing laboratories, in the standardising laboratories, in the departments which are interested in the testing of apparatus of different kinds, and in the development departments of the bigger manufacturing concerns, to allow research work to be carried on, and not only to encourage it, but to fit up laboratories and workshops for those who, showing promise, are desirous of carrying out independent investigations. By this is meant that in some of these works a youth or man who has shown himself possessed of keen intelligence, is allowed in the firm's time to attempt to discover new methods of working or to improve those already in vogue. This should also be done in this country, with this addition: that a higly trained electrical engineer should be retained to assist in every way possible the efforts of those who were engaged in the research. Many an industrial method could be simplified, many an investigation hastened and brought to a more successful conclusion were this course adopted.

It is almost common knowledge now that an entirely new branch of chemistry, the chemistry of the free atom, resulted recently from the exhaustive research work carried out in the chemical laboratory of a large electrical engineering firm, and the importance of this discovery, from a commercial point of view, cannot well be over-estimated. The invention of many new manufacturing processes has taken place in a number of trans-Atlantic research laboratories, and already in the United States the chemical engineer has become a recognised member of the engineering profession, solely through the establishment of research laboratories, although he is practically unknown over here.

Just as is the chemical engineer so is the electrical engineer destined to play a most important part in the development of every country's resources. Theirs will be the task of watching the laboratory experimentalist, of studying laboratory processes, with a view to devising stills, retorts, electric furnaces, machinery and everything necessary to carry out the discovered processes and methods on a commercial scale. Should a chemist succeed in making a few drops of some new dye, it will be the duty of the chemical engineer to devise apparatus that will manufacture it by the hundred gallons; should a new alloy of steel with nickel tungsten, chromium, molybdenum or other rare metal be discovered, the electrical engineer will find his work in devising a furnace that will be able to turn it out on such a scale that the steel-making supremacy of his country will be maintained against all competitors. Further, should some hitherto unsuspected property be found in a metal or an alloy, it will be the duty of both to devise some means whereby it can be turned to commercial advantage.

Perhaps one of the most important results which would be obtained from the extension of a system of technically assisted industrial research would be the training of men as skilled investigators. Results are seldom or never secured, as has been said before, by casual workers in the field or by those who engage in scientific work through the sheer love of science. The question what commercial use can be made of a discovery should always be before the eyes of a research worker. Unfortunately that is not always possible as matters stand, as the discoverer may have but the slightest notion of the value of his achievement. It is in such event that trained assistance, such trained assistance as can only be given by the chemical and electrical engineer, becomes necessary. The experimentalist, as a rule, makes it his whole business to find out hitherto unsuspected laws of Nature, and simplify them, and increase our knowledge and understanding. This is a work to which, as one who has had long and profitable experience of it once said, those who engage in it must pay undivided attention; it is for the technically trained man to take the results and turn them to an industrial end. Otherwise we shall find that the men engaged in our research laboratories will be investigators first and all the time; they will be men who will fight their way along the path of knowledge, seeking only what lies before them and taking little or no heed of what they have done as they passed along. Condensed into its least compass, the final object of industrial research work is to enable us to use the resources of Nature to better purpose to-morrow than we can do to-day, and that is only possible if we provide the man who is carrying out the work with trained assistance, to turn his results to the best advantage.

ELECTRICAL COOKING AS APPLIED TO LARGE KITCHENS.

On January 14th the Newcastle-upon-Tyne Local Section of the Institution of Electrical Engineers discussed Mr. W. A. Gillott's paper.

The Chairman, Mr. A. H. Marshall, in opening the discussion, said economy in cooking was, at the present time, of vital importance, even more important than fuel economy. When engineers looked into that question they generally had regard to the quantity, or the cost, of the fuel used in cooking by gas or coal-fire, or the amount of fuel it took to generate the amount of electricity used, and then left the cooking alone; but there were many considerations that modified comparisons of that kind—for instance, that of thermal efficiency—and this was rapidly increasing in the case of electricity.

Mr. Pinkney said he thought the subject was not receiving the attention it ought to have had. The question of large cooking installations was one for the engineers. Referring to the maintenance figures, he said that, apart from the character of the installation, maintenance costs would go down, due to better handling by the users. The cooking question would have to be met by the supply authorities—that was, the question of large kitchens, for the question of domestic cooking was a different problem altogether. One great point in electric cooking was that there was no chimney, and, consequently, no loss of heat in that way. A great many pessimists had said that electric cooking could not be done cheaply; it had been done cheaply, in spite of everything.

Mr. W. Sowerby said he was not an electrician, and he spoke on the subject merely as a business man. His firm, proprietors of cafés, asked him to take out the costs of different modes of cooking—coal, gas, and electric; he had to go thoroughly into the matter, and report. They knew approximately the cost of cooking by gas and by coal, and then he applied to the Newcastle Electric Supply Co. He said: "We are going to provide so many persons with so many meals; can you tell us what it will cost us per meal to do the work by electricity?" The company made an estimate and submitted it. His company were astonished; indeed, they thought a mistake had been made, but the Supply Co. confirmed their statement, and said they were prepared to go on with the work. The work was carried out, and he might say that after a period of 12 months their costs were considerably below those furnished in the estimate. When they put in the apparatus their friends said, "Ah, wait until you get the bill"; they had got the bill, and they were quite satisfied. The installation was not fool-proof, and needed care. He particularly spoke of the saving by the use of the calorifier in the heating of the water. He believed a good deal of their success was due to the fact that they charted their consumption, and, if the figures were excessive, raised the question with their employés.

Mr. C. Turnbull said he agreed both with the lecturer and the speakers that there was a great future before electrical cooking. He thought one reason why they were not going ahead was that the manufacturer did not appreciate the necessity of making everything easy of repair; everything should be made so that it would be easy to get at any part. He should not be surprised, if the amount of cooking increased, if it assisted in bringing about the downfall of D.C., and made alternating current general, for cooking with A.C. had many advantages.

Mr. Gillott, replying, said he agreed with the speakers that electric cooking was bound to extend. Three or four years ago he suggested to an electrical company that cooking was going to oust from its position their small power load; the suggestion was met with a smile, but, as a matter of fact, they had passed it, and he thought that in 10 or 15 years' time electrical cooking would be one of the biggest sides of electrical undertakings. Mention had been made of thermal efficiency; it reminded him of a gas representative who said he could give a customer 9,000 B.TH.U. for 1d., and that the electric companies could not give 5,000. He was asked what was the efficiency. He could not say. "Would it be 50 per cent.?" The gas man thought that would be high. Yet their electrical efficiency was 95 per cent. But running cost was not the most important item; there were so many advantages to be obtained in other directions that cooking by electricity would be cheaper at ¾d. per unit than if they got gas for nothing. It was a bold statement, but he was prepared to prove it.

A CONSTANT-TORQUE MAGNETIC CLUTCH.

The device described below consists of a differential electromagnetic clutch or coupling, which may be used to connect an electric motor, or other prime mover, to a dynamo, or to connect an electric motor to a mechanical load. It has been patented by Messrs. Walter L. Davies and Alfred Soames for controlling (*a*) the electrical output of a dynamo, (*b*) the mechanical output of a motor.

Fig. 1 shows it employed in driving a dynamo supplying current to an arc welding outfit at Faraday House, and fig. 2 is a diagram showing the basic principle upon which it operates.

In this clutch there are three coils, A, B, and C; A and C consist of many turns of fine wire, and B is a series coil consisting of a few turns of thick wire. No part of the clutch moves longitudinally; thus its reluctance remains constant, and the variation of the magnetism produced by the coils varies the pressure between the clutch members only.

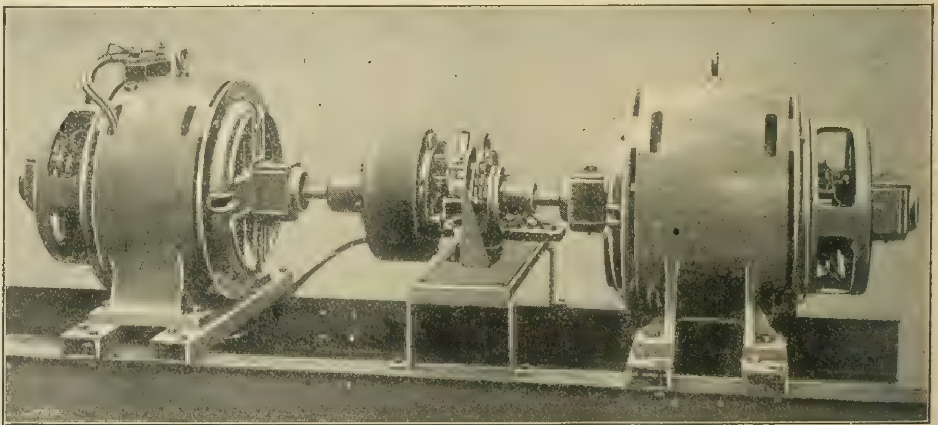

Fig. 1.—Motor Driving Generator through Electromagnetic Clutch.

The action of the clutch is as follows:—Coil A is energised either from the mains or from a small exciter on the *driving* shaft, and produces an initial pressure between the clutch members which is more than sufficient to transmit the load.

Coil B is connected in series with the dynamo armature, and its polarity is such as to counteract the pressure produced by the coil A.

It will be seen that as the current in coil B increases, *i.e.*, as the load is increased, the pressure between the clutch members *decreases*, until a point is reached when the pressure on the clutch is only just sufficient to transmit the load without slipping; past this point, the clutch slips. It is apparent, therefore, that the current taken from the dynamo cannot exceed a given maximum, even if it is short-circuited. The particular maximum to be reached can be controlled by adjusting the excitation of the coil A with a rheostat.

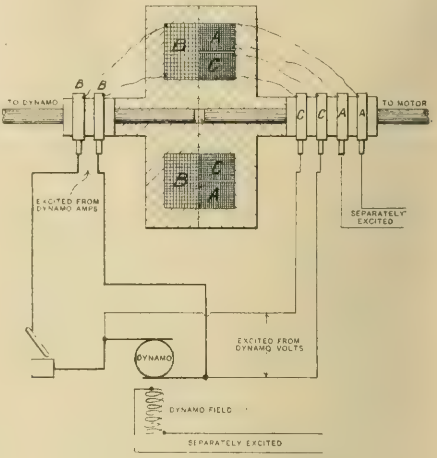

Fig. 2.—Diagram of Circuits.

In the case of a simple electromagnetic clutch with constant excitation, the coefficient of friction drops rapidly when slip commences to take place, and therefore, if the pressure remains constant, the clutch will slip to about half-speed if called upon to give a constant torque (corresponding, in this case, to constant current in the dynamo circuit). To counteract this variation in the coefficient of friction, coil C has been added; this coil is connected across the brushes of the dynamo, and its polarity is opposite to that of coil A.

The effect of these three coils is as follows:—On open circuit coil A gives an initial pressure; coil C, which is across the dynamo brushes, reduces the pressure produced by A. If current is now taken, the coil B still further reduces the pressure, until a point is reached when the clutch slips, but when the clutch slips the volts of the dynamo decrease; this decreases the effect of C, which is equivalent to increasing the effect of A, and by this means the slip is prevented from unduly increasing. Should the current taken from the dynamo tend to increase, the action of the series coil B would decrease the pressure, and, as a result, the coils B and C adjust the pressure so that the current remains practically constant.

Since the dynamo is separately excited, its field remains constant, and (owing to the clutch) the armature field is practically constant at all speeds, therefore there is no sparking at any speed, and the dynamo can be instantly short-circuited from open circuit without any harmful result. By suitably proportioning the coils A and C, any desired characteristic may be obtained.

Since this clutch acts not only as a current regulator, but as a kind of mechanical overload release, readjusting itself when the overload is removed, its applications are very wide; three of these may be indicated, namely, electric arc welding, battery charging, and as a coupling in motor-generator sets, especially those used for tramway supply.

The advantages of this arrangement for electric arc welding are as follows:—

Any dynamo giving sufficient power may be used, and be driven from any suitable source of power, its characteristic being so altered as to make it suitable for the work.

The maximum current to be taken can be set at any value within the limits of the dynamo rating.

When the desired current has been set, it remains practically constant from short-circuit to the maximum length of arc that the volts will maintain; there is no necessity to snatch at the arc when striking it, the electrodes can be rubbed together, and the arc drawn out as desired. A short arc does not produce a rise of current and consequent burning; the operator is thus enabled to give his full attention to the work, as the arc cannot run away from him.

There is no resistance whatever introduced into the welding circuit, consequently *the whole of the watts generated are used upon the work;* this not only reduces the operating cost, but substantially increases the plant efficiency.

Since the clutch only slips on an overload, the power lost by it when running is entirely negligible.

For controlling the mechanical output of a motor, a similar clutch wound with the three coils A, B, and C is used, but in this case the B, or series coil, is in series with the motor armature, and its action is to make the clutch slip when the motor takes the maximum current it is to be allowed. A very small dynamo is attached in any convenient position to the variable-speed side of the clutch, so that its volts will vary with the speed; this dynamo energises the C coil, and compensates for the variations of friction as previously explained.

The clutch is obviously suitable for driving any class of machinery subject to sudden shocks, or to very intermittent loading, such as rolling mills, stamping presses, heavy lathes and planing machines, shears, &c. It gives complete protection to machinery likely to be jammed, such as anchor winches, capstans, and winding drums for hauling trucks in mines.

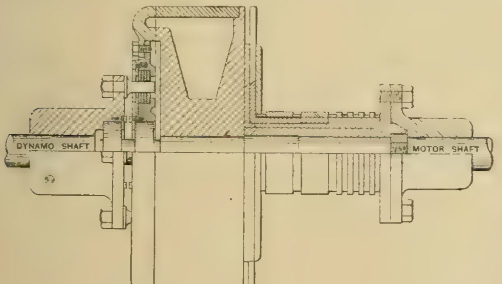

Fig. 3.—Section of Clutch.

The device can also be arranged as a hand-operated magnetic friction clutch. The chief difficulty met with in designing electromagnetic friction clutches of this type is due to the residual magnetism, which prevents the clutch releasing when the current is reduced or switched off.

In the clutch under consideration, the magnetic circuit has been made as compact as possible, so much so that it will transmit 1,000 watts of electrical power with a consumption of less than 1 watt, *i.e.*, 1/10th per cent. loss. The residual magnetism of this clutch is over 50 per cent., but owing to the special method of operating it, this residual magnetism is completely swept out, on releasing the clutch, and it can be operated at any degree of slip and any load *gradually* upwards and downwards between zero and full load.

In consequence of the excellence of the magnetic circuit, if desired this clutch may be arranged to be magnetised to a higher density than that required to transmit the load, in which case the current can be cut off altogether when the clutch is transmitting full load, the residual magnetism being sufficient to carry the load, and the clutch works without any consumption of energy at all, the current being only employed to pick up or release the load.

The clutch itself is simply a well-designed electromagnet, wound with a single magnetising coil, connected to one or two slip-rings, and connected to the circuit as follows:—

In fig. 4 A is a small battery, or other source from which a small current may be obtained. This battery is connected to the opposite sides of a continuous resistance R, R, R, R. Two brushes B,B, are arranged to slide round this, and the ends of the clutch coil C are connected to these brushes.

It is obvious that if the brushes are in the position x′ x the clutch receives its maximum current; if they are slid round in the direction of Y′ Y, the current decreases to zero at Y′ Y, and if they are slid on in the same direction to some such position as z′ z, the current in the clutch reverses and rises in the opposite direction.

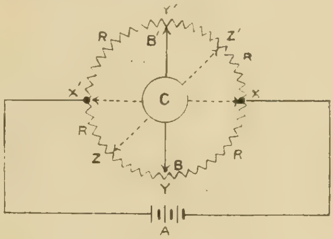

Fig. 4.

To release the clutch from full load, the brushes are slid round from x′ x in the direction of z′ z until the current is reversed, and rises sufficiently in the opposite direction to sweep out all the residual magnetism.

Stops are placed at x′ x and z′ z; the clutch can then be worked with a perfect gradation of slip between these points.

In the clutch shown the power consumption over the clutch coil and the resistance R, R, R, R amounts to about 2 watts per 1,000 watts transmitted.

We recently visited Faraday House, and had the pleasure of seeing the foregoing features fully demonstrated by Mr. Davies. We may point out that the clutch is not intended to slip continuously, after the style of a slipping-belt drive, though it could do so if necessary without overheating. Even on so erratic a load as arc welding, with the arc purposely handled in the jerkiest manner, the clutch maintained a practically constant current, and in all respects substantiated the inventors' claims on its behalf.

GAS FIRING BOILERS.

Mr. T. M. Hunter's paper was read before the Yorkshire Local Section of the Institution of Electrical Engineers on January 15th.

Mr. W. Lang (Chairman) said the subject was one that interested practically the whole of the country at the present day.

Mr. C. N. Hefford (Leeds) said he gathered that the paper was designed for the assistance of engineers who were connected with coke-oven processes, or ironworks where waste gas existed. He did not draw any information from the paper which would encourage one to go in for steam-raising from gas-fired boilers where one had to consider the obtaining of gas purely for that purpose. A continuation of Mr. Hunter's paper showing how an expert would deal with the problem of generating 2,000,000,000 lb. of steam per annum from gas-fired boilers, and information as to what capital charges would be necessary, would be useful. Such a steam-raising plant could not be accommodated in any large centre of industry, but would need to be adjacent to some colliery. There would have to be an enormous economy in generating electricity if the removal of central stations from towns was going to be justified.

Mr. Harris remarked that it would be absolutely out of the question for steam users in manufacturing towns to make use of gas for such purposes. What interested them most was what use could be made of producer gas in towns for steam raising. He knew quite a number of places that put down gas plant years ago, but he could not think of one that was now in existence. If the power at an electric light station was got from gas firing the plant would have to be very large. He desired to know if there was any first-class installation of boilers fired with producer gas. Collieries used to have large quantities of refuse fuel such as shale, coal dust, and numerous other things which they threw away. Many of them were now using that refuse, and getting just as good evaporation from their boilers through the use of modern appliances as they previously got with ordinary hand stoking.

Mr. Wilson Hartnell (Leeds) considered that if consumers could get waste gases from a coke oven they might use them with advantage, but he did not think that could be done in Leeds.

Mr. W. Howard Brown (Bradford) recalled experiments made a few years ago with gas from some blast furnaces which proved failures. The gas appeared to be all right, but there was very little heat in it, and the consequence was that before the full load was reached a considerable use of coal had to be made to keep the steam pressure up. The question of gas firing for boilers was probably not so important in Yorkshire as it was in the South of England. It would be well if the lecturer could, at some time, give them another paper which would deal more with the practice of burning producer gas.

Mr. A. Terry (Leeds) wished to know whether, in view of the proposals made by the recent Committee on Electrical Supply, the author of the paper proposed that the installation should be situated close to the coal mines, and the coal be first used in by-product ovens.

Mr. J. Shepherd (Leeds) observed that the paper was extremely interesting, but was disappointing in one way because if left untouched the great problem, which was: "Where power is needed, what is the best way to get it?"

Mr. T. M. Hunter, in replying on the discussion, said with regard to transmission, the transmission of electricity was a very expensive matter, whilst the transmission of gas was a very cheap matter, and the losses on transmission of gas were very small. The American figures for loss in transmission were from .5 per cent. up to about 2 per cent., and gas there was sometimes transmitted for 100 miles or so. Gas was transmitted under high pressure. If gas could be generated outside the towns and transmitted in pipes to the existing power stations, those stations would be used very economically, and they could generate electricity without increasing the capital charges. To blast-furnace proprietors, gas at the present time was a very valuable product. They could not hope that a gas producer plant could take peak loads for steam-raising purposes. They could never press a producer plant. Some other method for taking peak loads would have to be resorted to. The provision of superheated air was very important with regard to gas firing, as it was with coal firing. On the Continent they were far ahead of us in this matter. The installation of the Yorkshire Waste Heat Co. had been very successful.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

GRENADA.—The Board of Trade have received information that the recent Proclamation prohibiting the importation of electrical apparatus and other articles—noted in the Electrical Review for September 7th—has been revoked.

RUSSIA.—By a Customs Circular dated August 3rd/16th, the Minister of Finance has sanctioned the following interpretation of the Customs Tariff as regards electric fuses:—

Electric fuses complete, with interchangeable working parts, in the composition of which there is usually silver in the form of connecting wire, forming a very inconsiderable part of the weight of the fuse, are to be admitted under Section 169, point 1 (the duty thereunder is 13 roubles 20 copecks per poud). Separately imported working parts of electric fuses made of common materials, with wire of low-proof silver (below 84 proof) are to be admitted under Section 169, point 1, in accordance with the Note to points 1 and 2 of this Section; and similar working parts of fuses, with wire of high-proof silver, under Section 148, point 4, as manufactures of silver (the duty being 9 roubles 90 copecks per funt).

[Poud = 36.114 lb. avoirdupois; funt = 14.45 oz.; rouble (100 copecks) = 2s. 1⅓d. (par rate).]

ITALY.—The revision of the Italian Tariff has reached a further stage by the publication of a law appointing a Parliamentary Commission for the examination of the new draft Customs Tariff which the Government is to draw up and submit for legislative sanction. The Commission is to consist of 15 Deputies and 15 Senators of the Italian Parliament. The proposals of the Royal Commission appointed to study the question are to form the basis of the new Tariff.

In regard to the existing Italian import prohibitions, it should be noted that it is necessary for importers to obtain licences for the import of British goods, with the exception of certain foodstuffs, raw materials, chemicals, &c. At present, applications for such licences must be submitted by the would-be importers to the competent authorities, through the medium of Italian Chambers of Commerce.

UNITED STATES.—Full details of the American export prohibitions are now available. As was to be expected, the list of prohibited goods is very comprehensive, and includes, *inter alia*, all engines and motors worked by electricity, all electrical equipment, metals, and wireless apparatus and accessories.

Applications for export licences must be made by the exporter to the Exports Administrative Board at Washington, or 11, Broadway, New York. They will be valid for 60 days, unless previously revoked. Licences for certain articles will only be issued if such articles are destined for actual war purposes, or for purposes directly contributing thereto. The prohibitions affect goods in transit through the United States, as well as domestic products. For consignments not exceeding 100 dols. in value, export licences may be granted under special declarations.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

336. "Ignition magnetos for internal-combustion engines." A. F. March. January 7th.

354. "Railway signalling." McKenzie, Holland, & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 7th.

363. "Apparatus for measuring want of equilibrium in galvanometer coil, &c." J. Rymer-Jones. January 7th.

379. "Telegraphic apparatus." E. A. Willson. January 7th.

386. "Electrically-propelled vessels." F. Ljungstrom. January 7th.

395. "Sparking plugs, &c." G. H. Ward. January 8th.

404. "Means for attaching mouthpieces of telephones, speaking tubes, &c." Taylor, Tunnicliff & Co. and E. D. M. Scrivener. January 8th.

411. "Electron-emitting cathodes, and process of making same." Western Electric Co. (Western Electric Co., U.S.A.) January 8th.

420. "Electrodes for electric welding." Quasi-Arc Co. & A. P. Strohmenger. January 8th.

422. "Electric lampholders." J. H. Collings & M. J. Railing. January 8th.

423. "Electric guns." L. M. Bowman & W. A. Smith. January 8th. (U.S.A., May 29th, 1917.)

431. "Overhead system of electric traction." A. Orom. January 8th

436. "Electric wall plugs, &c." J. R. Craig. January 8th.

458. "Sparking plugs for internal-combustion engines." R. Taylor. January 8th.

474. "Incandescent electric lamps for projection purposes." D. Lely and Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 8th. (Holland, June 2nd, 1917.)

478. "Transformation of polyphase into practically constant direct currents." O. M. Corbino. January 8th. (Italy, January 8th, 1916.)

480. "Telephone systems." Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) January 8th.

523. "Receiving radio-signals." Marconi Wireless Telegraph Co. January 9th. (U.S.A., July 19th, 1917.)

534. "Sign telegraphs, &c., electric advertising devices." H. K. Harris. January 9th.

545. "Winding with equipotential connections for drum armatures of electric commutator machines." E. C. R. Marks (Akt. Ges. Brown, Boveri et Cie.). January 9th.

551. "Manufacture of carbon electrodes." B. E. D. Kilburn (Norsk Aktieselskab for Elektrokemisk Industri). January 9th.

555. "Audion or lamp relay or amplifying apparatus." M. Latour. January 9th (France, January 9th, 1917.)

557. "Silencing pads for telephone or speaking-tube ear pieces and ear stoppers." A. C. Brown. January 9th.

561. "Electric switches." A. H. F. Perl. January 9th.

574. "Electric switches." G. O. Donovan & W. Donovan. January 10th.

579. "Electric air purifier and destructor." W. J. Calder. January 10th.

587. "Magnetic separators." H. Cornell. January 10th. (Australia, January 12th, 1917.)

590. "Signalling device for aircraft." H. Ebury. January 10th.

600. "Manufacture of electric cables." C. J. Beaver & E. A. Claremont. January 10th

609. "Galvanometers for measuring-instruments." Cambridge Scientific Instrument Co. & E. C. Hurst. January 10th.

615/6/7. "Electric starting apparatus for motor vehicle engines." H. Lucas & C. L. Breeden. January 10th.

662. "Electric replaceable fuses." M. H. Goldstone. January 11th.

673. "Ventilating devices for electrical machinery, &c." Siemens Schuckertwerke. January 11th. (Germany, December 22nd, 1916.)

676. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) January 11th.

684. "Circuit arrangements for operating selecting devices of telephone installations by number impulses." T. Pettigrew. January 11th.

704. "Machine switching telephone systems." L. Polinkowsky & Western Electric Co. January 11th.

723. "Power generating devices." J. Peterson. January 12th.

729. "Electrode holder for electric furnaces." J. E. Robinson & C. W. Kayser. January 12th.

738. "Sparking plugs." D. Collins. January 12th.

754 "Magneto-electric machines." L. G. Caunter & F. W. Suter. January 12th.

757. "Electric transformers, &c." A. Schaanning. January 12th.

760. "Sparking plugs for internal-combustion engines." W. D. Brand. January 12th

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,934. Arrangements for Advancing the Ignition in Internal-combustion Engines. Soc. Anon. pour l'Eclairage Electrique des Vehicules. December 20th, 1915. (102,951.)

18,144. Magnetos with Fixed Armatures. E. C. R. Marks (Soc. Anon. des Etablissements L. Bleirot). December 18th, 1916. (112,038.)

1917.

436. Induction Coils or Transformers. M. A. Codd. January 9th, 1917. (112,051.)

713. Electric Lamps for Motor Vehicles and for other purposes. C. F. L. King. January 15th, 1917. (112,055.)

2,340. Process for joining up Electric and other Wires. J. H. van Viersen, and Slot & Zwijnenberg. September 2nd, 1916. (109,432.)

7,606. Cores for Pupin Loading Coils, Magnets and the like. Western Electric Co. May 26th, 1916. (107,007.)

8,598. X-ray Tubes. W. J. Robinson. June 15th, 1917. (112,101.)

8,726. Device Applicable to the Spring-controlled Switches of Telephone Receivers. A. S. John. June 18th, 1917. (112,102.)

8,949. Diaphragm Vibrators or Sounders. H. S. A. Rydberg. June 30th, 1916. (108,305.)

14,981. Continuous-current Dynamos. F. Kesellring. June 8th, 1916. (Divided application on 8,150/16.) (112,116.)

THE

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THE WORLD THAT IS TO BE.

IN discussing some of the problems connected with the vast work of reconstruction a few weeks ago we expressed the opinion that the Department presided over by Dr. Addison must inevitably become the greatest of all Government Departments. Closer acquaintance with its manifold operations, which the Minister of Reconstruction has again privileged the Press to make, confirms and strengthens us in that opinion. Our fear is that the necessity for continuing our military, naval, aerial, and munition-manufacturing efforts makes so imperative a demand upon the efforts of most of us that the truly fascinating story of reconstruction investigations and plans cannot be read by the millions as it deserves to be. Dr. Addison may be able to educate thousands of hearers at the meetings that he is addressing in different parts of the country, but he is handicapped, in our opinion, by the inability of the Press to give that detailed publicity to his utterances that future, and perhaps immediate, national necessities demand. We would say frankly that we believe it to be one of the most urgent needs of the moment that the Cabinet should see that the Press which is responsible for the education of the people should be freed to the utmost limit of Governmental power from restrictions of labour and of paper supplies. Dr. Addison may educate his thousands, but the serious Press, through its thousands of voices, may educate the masses if only its working conditions can accommodate themselves to full and free publication of all that reconstruction means, the foresight with which its problems are being investigated, and the thoroughness with which its plans are being made. It is deplorable that this light has to be hid under a bushel, for knowledge of the measures that are in prospect would, we believe, go far to allay certain nervousness in regard to the future, and to fill with hope and confidence those who are wondering however it can be possible for affairs to be brought back to anything like normal conditions without a crash.

The work of reconstruction is, of course, an undertaking of most exceptional complexity. It must touch at some point or other every department of public and private activity—all classes, all industries, all trades, all professions. Since August last the Chief Designer and his associates have been designing the whole as one grand mosaic, and bit by bit the parts have been fitted in until, in theory at any rate, it is possible to see what must, or should, be done in order to facilitate the orderly return of men and industries, food and materials, finance and shipping, and so forth, from the chaos and confusion of war to the constructive operations of peaceful life. True it is that some parts of the great mosaic may yet be wanting, or that some parts will have to give place to others as experience is gained; also, there may be ground for wondering whether unexpected factors will intervene to jumble up the whole. But the theoretical design will stand a far better chance of being developed into one grand national effort to carry it into practical effect, with the hearty co-operation of all parties, if the public confidence can be secured by the aid of maximum publicity. Naturally enough, during the last six months manifold sections of industrial life have been called into counsel concerning the future of their own particular interests, and to that extent it is becoming known what is to be expected, but we repeat that everything is to be gained by letting the public know in their millions the story of the whole. The speeches of a Hertling and of a Czernin are as we write of supreme importance, but the Press has its limitations, and if such speeches were by any change of good fortune to lead to more hopeful signs of an early end of the war, the people would know far less than they ought to know concerning what is to be expected to happen after the war. We do not forget that a certain Minister, not unknown for an aptitude for "butting in," once "butted in" with the brilliant advice that we should leave after-the-war to look after itself. We cannot afford to do that now, as those who know the manifold, the almost overwhelming, problems that are commanding Dr. Addison's attention are fully aware. Many of those problems may be destined to come shortly before legislative assemblies in the form of concrete proposals, for there is a legal section which is examining all propositions with a view to determining what amendments of the existing law are involved. It will be a pity if a whole host of legislative proposals has to be brought forward for adoption in a hurry unless the public mind has been prepared for them.

As space permits we shall refer to the work of the Reconstruction Ministry, but for the present we must be content with little more than a general outline of the four main departments. This alone will serve to indicate the vastness of the area to be covered. Class "A," which will deal with commerce and production, of course includes the supply and control of raw materials after the war. We have done our best to acquaint the industries with which we are concerned with the need that exists for them to connect themselves up into the form of organised trade associations if they desire to secure a fair and equitable apportionment of such materials as are available after the war for urgent industries which have a reasonable claim to priority of treatment. The same Class is dealing with the important question of financial facilities for British commerce and industry; with the preservation of industries which play an essential part in reconstruction, but are in danger of extinction through failure of supplies of material or labour; with the establishment of new industries after the war; with the volume and nature of the demand for British goods after the war; and with the improvements in trade organisation for the purposes of more economical production, distribution, and marketing, and of facilitating and expediting the turn over from war to peace. Here alone we have questions enough almost to bewilder the industrial mind. The situation with which this Class is faced is described thus: After the war there will be a world shortage of certain materials, and the shortage will be accentuated by the difficulty of finding tonnage adequate to our demands; on the other hand, there will be an almost unlimited demand for manufactured goods. By estimate and analysis, we shall get to know the available supplies of ourselves and of our Allies, and shall determine also the demand, the nature of it, and the priority order which must be imposed in regard to materials, labour, power, tonnage, and credit, for the good of all. We shall want to re-establish industry with the utmost expedition, avoiding causes for undue distress as far as possible in any department, and the Government policy will be to leave industries to ration themselves. Can this be done as readily where isolated units have to be dealt with, or by negotiating through large associated committees formed from representative trade associations and bodies connected with particular industries? There is only one answer, and the individual duty is therefore plain.

The second leading Class, "B," will cover matters affecting finance (currency and exchange), shipping, and common services, and will include the disposal of vast Government stores. Class "C" will cover the immense problems of labour and industrial organisation. Here we touch such matters as the relations of employer and employed, and the Whitley Report comes under attention as the one outstanding constructive proposal to that end. But, as we have said already, what do the mass of workers know about the Whitley Report at present? A professional man the other day, busy with all sorts of pressing activities, asked us in the most childlike and bland manner: "What is the Whitley Report? I have never heard of it!" A speaker going to a working-class district to hold forth on the problems of industry and the breaking down of class enmities, was advised, "You had better assume that the audience knows nothing about the Whitley Report!" May we again repeat how sadly we are at a loss for want of full and free publicity concerning matters of such vital importance? Dr. Addison must not be surprised if such proposals are not widely acted upon if the public have never properly understood them or been impressed with their urgency. The Whitley Report stands for a great principle, and each industry must consider for itself how far and in what manner it can be applied. We seem to be in need of a "Peace Aims" Committee as well as a "War Aims" Committee, and matters should not be left for promulgation by one voice crying in the wilderness about the paths that need to be made straight for the coming of national salvation. Class C will also in some measure concern itself with demobilisation. We will only touch one point now to show where its activities may be very beneficial. The return of "pivotal" men in advance of the mass of workers will prepare the way for the latter to start work immediately after the promised Peace holiday. The selection of the right men will rest with associations who will be able to evaluate the services of individual men to a particular business or firm. This is an excellent point, and we believe is a tribute to the foresight which the Reconstruction Department is displaying—in theory, of course, at present. We trust that it will be found to work out according to design, for much may depend upon it when the nation is rocking on the waves of uncertainty and change. There are other Classes which will bring foresight, ingenuity, and legislation to bear upon questions relating to rural development, the machinery of Government Departments, health and education, housing, and internal transport (roads, canals, &c.), but these we can only thus crudely indicate just now.

What may emerge from all that is happening among the statesmen and peoples of enemy countries who can say? In the midst of war we must be preparing for peace. Dr. Addison, we believe, will merit the gratitude of millions if the schemes of which he is the father can be carried through in such a way as to enable us to bring peace, prosperity, and happiness in the nation when the battle-drums cease to beat in Flanders, but he can only prepare the way for those eagerly awaited times by an intelligent understanding and acceptance of his proposals on the part of the people. The Prime Minister, with his great qualities of imagination and vision, and his capacity for leading Democracy, assuredly sees that quite well. No doubt when he observes the right signs on the horizon he will speak words that will transform for the multitude the manifold details of Dr. Addison's unobtrusive operations, and will lead the people to hopeful contemplation and co-operation in ways which may save the situation in the early days of Peace, just as he helped to save the Allied cause for us all at critical stages of the War.

GERMAN INFLUENCE IN THE SWISS ELECTRICAL INDUSTRY.

It is scarcely surprising to learn, in view of the geographical proximity of Germany and Switzerland, that the question of the former's influence on the latter's industries has been brought forward for discussion, on the general principle that the war has evoked a desire in every country to transform all industries, where possible and deemed necessary, into undertakings of a strictly national character in those cases where foreign interests are also concerned. In Switzerland certain daily newspapers during the past 12 months have published what are termed more or less sensational articles referring to German penetration, particularly in the Swiss electrical industry. The Comité de l'Union des Centrales Suisses d'Electricité recently had occasion to reply to one of these articles which was couched in general terms, and contained, it is stated, false assertions concerning Swiss works, and now the Comité of the Association des Electriciens Suisses has taken the matter in hand as a result of the publication of further articles, repeating the same statements, and mentioning names. With this object in view the Comité requested M. E. Tissot, administrateur-délégué of the Banque Suisse des Chemins de Fer, of Basle, who is a competent engineer well known also in French technical and industrial circles, to clear up the situation by means of an article, which is printed in the Association's *Bulletin* No. 12.

The author divides his article into three parts, the first dealing with supply works, the second with electro-metallurgical works, and the third with manufacturing works. The companies mentioned in the first class are those of Olten-Aarburg, with its Olten-Goesgen works, the Beznau-Löntsch, the Rheinfelden, and the Lauffenburg Companies. It is explained that practically all the capital of the Olten-Aarburg Co. is in Swiss ownership, that the Beznau-Löntsch undertaking has become the property of the State (the North-Eastern Swiss Cantons), that the Rheinfelden Co. is domiciled in, and controlled by, Germany, and one works is situated on German territory, whilst the second works (Wyhlen, in Baden) has a barrage in common with the Swiss Augst works; and that about 60 per cent. of the capital is held by Germans, who had a majority on the board of directors at the end of 1916. As to the supply of energy from these works to other countries, it is mentioned that, according to the table of power exported from Switzerland at the end of October, 1917, the deliveries to Italy and France represented 71,806 H.P., and those to Germany 53,617 H.P. It is explained in this connection that agreements under which the concessions were granted authorised the exportation of energy, that the export authorisations are only for a relatively short period, and that some works would not have been brought into existence if the owners had not been guaranteed beforehand a considerable revenue by means of contracts entered into with foreign distribution companies.

Coming to consider the second group of works, the author first refers to the Neuhausen Aluminium Industry Co., the majority of whose share capital is stated to have been already held by Swiss investors prior to the war, whilst in the meantime further shares held by Germans have been returned to Switzerland. It is estimated that the maximum amount of the share capital held by Germans was one-third of the total capital at the end of 1915, and almost all the loan debt has been raised in Switzerland. Notwithstanding this state of affairs, the German members of the board of directors numbered nine in 1908 as compared with three Swiss, and six in 1914 as against the same number of Swiss, but in 1916 the Teutonic element declined to five, as contrasted with nine Swiss. It has to be noted, too, that although the company does not belong to any special financial group, German finance is represented in it by the Deutsche Bank and the Berlin Handels Gesellschaft, whilst the A.E.G. has played an important part in the foundation and development of the undertaking. In this connection some interesting figures are given respecting the total exports of aluminium from Switzerland. The Neuhausen Co. practically has a monopoly of the production, as the output of the Giulini Co., at Martigny, is insignificant, and consequently the exports almost entirely emanate from the former. It is shown that the value of the exports to Germany, which only amounted to £476,000 in 1914, increased to £1,395,000 in 1915, and further to £1,760,000 in 1916. On the other hand, the exports to France were of the value of £10,000, £39,000, and £81,000, and to Italy £13,000, £7,000, and £56,000 in the same years respectively, whilst the exports to Great Britain were of still less importance.

The position of the Usines Electriques de la Lonza, of Basle and Gampel, is next referred to. Swiss capital and Swiss directors always having had the preponderance in the undertaking. It is considered that from 60 to 65 per cent. of the company's production of carbide of calcium and ferro-silicon is forwarded to Germany and Austria, although a portion also finds its way to France, and a still smaller quantity to Italy. The production of the Gothard Werke, A.G. fur Elektrochemische Industrie, of Bodio (Tessin), also comprises carbide and ferro-silicon, and as one-half of the share capital was subscribed by Germans, it is held not to be surprising that a large portion of the output reaches Germany. On the other hand, the works of the Carbures du Day, which are also situated at Bodio, are declared to be working solely for the Allied Powers, and the same remark also applies to several other electrochemical works in Romand Switzerland. If the horse-power exported from Switzerland is added to the horse-power utilised in the manufacture of electrochemical products for export, it is shown that the power placed at the disposal of the Central European countries amounts to 164,000 H.P., as contrasted with 114,500 H.P. in the case of the Allied countries, and the latter total will soon be increased by 3,750 H.P. by the bringing into operation of a new works in the Tessin, and by a further 20,000 H.P. at no distant date by the starting of works on the Franco-Swiss Rhône.

The author finally proceeds to refer, somewhat briefly by comparison with his statements concerning the supply and electrochemical works, to the manufacturing branch of the industry, and in this case he only mentions two firms: Brown, Boveri and Co., of Baden, and Escher, Wyss & Co., of Zurich. In the former case the combined share and loan capital totals £2,381,000, and the board of directors was composed of four Germans and nine Swiss in 1913, and three Germans and 10 Swiss in 1914, but the Germans do not appear for 1916 and 1917, the number of Swiss directors remaining at 10 in each year. It is stated that the A.E.G. felt the competition of Brown, Boveri & Co., and endeavoured at one time to obtain possession of the company by an interchange of shares and directors, but that the former found it impossible to convert the latter into a subsidiary, and only Walter Rathenau remained on the Baden board until 1914 as representative of the Zurich Bank for Electrical Undertakings, which was founded by the A.E.G. No mention was made in the annual report of Brown, Boveri & Co. for 1914 as to the cause of the resignation of W. Rathenau, but it is assumed to have been due to his accession to the board of the A.E.G., of which he became chairman on the death of his father. The total investments of Brown, Boveri and Co., probably for the most part in other countries, reached £1,044,000 in April, 1917, of which £600,000 is assumed to apply to Germany. It is considered certain, however, that German capital invested in the company, whose shares are quoted in Germany, is considerably less than this figure, especially having regard to the return of large parcels of shares formerly held in Germany, due to the favourable rate of exchange. The author, therefore, states that it is incorrect to speak of a German share (*rôle*) in this undertaking. It is known that the Baden works have never carried out war contracts, except for Switzerland, and a statement to this effect has been made in the company's annual reports, as previously mentioned in this journal. As contrasted with this position of affairs it would be surprising, it is stated, if the subsidiary companies and the undertakings in which the company is interested in Germany, Austria, France, and Italy had not worked for the national defence of the countries in which they are located.

The firm of Escher, Wyss & Co., which has a combined share and loan capital of £500,000, for a long time was under the influence of the A.E.G.-Lahmeyer group, who controlled the majority of the shares. This situation of affairs, however, has been entirely modified during the past 12 months, and out of 12 directors now only one is German, as compared with three in 1914. Although never having a majority on the board, the Germans played an important part in the company until 1916-17, when a group of Swiss banks and investors acquired almost all the shares then held by the A.E.G.-Lahmeyer group. Since that time the company has regained its independence. Apart from the fact that the author has refrained from mentioning any other Swiss manufacturing companies, it is rather unfortunate that he has thrown no light on the position of the works at Ravensburg, Wurtemburg, for the firm of Escher, Wyss are styled as of Zurich and Ravensburg. We ourselves are in some doubt as to whether or not manufacturing at this German town was discontinued a few years ago. If, however, operations at Ravensburg were abandoned, it is a pity that the company still retains, or at all events still adhered to in 1916, the second name as a business address, under the conditions of the war.

RESISTANCES FOR STARTERS AND CONTROLLERS.

By "X."

There is little difficulty in building resistances with metallic elements which are mechanically and electrically sound when the currents to be carried exceed 100 amperes on continuous rating, or 200/300 amperes on a two-minute rating, because the cross-section of the material is sufficient to give the required strength and rigidity even when a comparatively brittle metal is used. The difficulty becomes serious with currents of 50 amperes continuous rating and 100 amperes two-minute rating, and is acute with currents of 10/20 amperes and under. It may be mitigated at the higher limits by making the sections far too heavy for the current, but at the lower limits this waste of material is too great to be contemplated with equanimity.

Non-metallic resistance units, consisting solely of carbon in various forms or carbon mixed with sand or similar materials, have been tried from time to time, and have obtained a certain vogue, but they have never come into general use owing to the defects germane to the type.

Metallic resistances may be taken to hold the field for all practical purposes, and it is useful to review the methods which are in daily use to lessen their inherent imperfections and obtain the desired unbreakableness.

The term "unbreakable," so frequently used when specifying resistances, is rather misleading in this connection, because a resistance which is breakable, in the sense that it may be smashed with a hammer, may give far better results when suitably protected than one made of the toughest materials, but imperfect in other respects.

What is desired is an element which, on balance, possesses the fewest defects. The usual materials are cast-iron in the form of grids, sheet-iron, steel, or alloy as stampings, and wire of iron or alloy. A resistance made of wire offers many advantages over cast-iron or stamped grids.

Cast grids, unless made of malleable iron, are brittle; they cannot be made of small sections, and it is necessary to support the smallest section made in some special manner to prevent breakage in transit. The increase of resistance with temperature is considerable, and is prohibitive when anything approaching uniform resistance values is required; the variation of resistance between the grids due to slightly different mixtures is apt to be appreciable.

Stamped grids are an improvement, because they can be made of steel or an alloy with a small temperature coefficient, and the cross sections can be smaller than with cast-iron; but very small sections are either impossible or inadvisable, and grids of the smaller sections have to be very liberally supported to prevent buckling.

Wire resistances, being drawn, are tenacious, and there are sufficient sections manufactured to permit a close approximation to the most economical area for any required current-carrying capacity. The resistance may be adjusted exactly to the desired value, whereas it must, in practice, always be an approximation with grids.

Wires made of alloys with good lasting properties, very low temperature coefficient, and very little variation between one consignment and another are easily obtainable. The only difficulty consists in supporting and insulating the wire in a satisfactory manner without obstructing the free passage of air necessary to limit the temperature rise to a reasonable value.

The old-fashioned wire spiral was excellent as regards ventilation, but short-circuits from spiral to spiral, and from turn to turn, were frequent, especially on overloads. Many attempts have been made to produce something more substantial, yet well ventilated, with varying success. A form suitable for a large range of sections down to the smallest is the wholly, or partially embedded, and there are many variants of this type, such as enamelled metal plates with the wire in the enamel, wire wound on enamelled metal tubes, wire embedded in cements and supported in diverse ways, but they all suffer from the defect that to a greater or less extent the process is special, necessitating special tools or special mixtures, special methods of allowing for the expansion of the wire, either in the mixture or in the support, and adjustment or repair on site is difficult, if not impossible.

Another form suitable for small wires is a mat, or net of insulating fireproof material with the wire woven in the net. This method supports the wire adequately at first, but the material absorbs a great deal of moisture, and is liable to disintegrate on repeated heating and cooling, particularly when subject to vibration.

The material must be free from acid, to begin with, and must not be used when it can absorb acid from the atmosphere. Each mat has to be well supported and insulated if air is to circulate freely, and if the mats are assembled in a block for greater mechanical strength, the cooling surface is reduced to the minimum, and, in either case, it is not easy to tap off at the exact resistance value. A third form is made by crimping wire into large corrugations, and supporting each corrugated section on insulating material.

If the supports are numerous, the wire relatively thick, and the insulating material as fireproof as porcelain, this type is capable of good results, but it is difficult to avoid the use of a large number of small pieces of insulating material, and not easy to secure the wire adequately to the supports, or to support the terminals for the cables connected to the taps in a satisfactory manner. Repair and adjustment on site frequently necessitate considerable disturbance of the neighbouring units.

A fourth pattern is made by winding the wire in a spiral groove on a heavy earthenware cylinder, which is supported by, and may be insulated from, a metal rod at the axis. This form is suitable for all sizes of wire; the grooves adequately prevent contact between turns, and support the wire throughout its length.

The cylinder may be glazed or made of china when it is necessary to expose the resistance to the weather; double insulation is provided by the cylinder and by the insulation between cylinder and rod, and triple insulation for very severe conditions may be obtained by insulating the rods from the supporting frame. The cylindrical section ensures plenty of air space between the elements, and the wire-wound cylinder successfully withstands rough handling far in excess of any it can possibly receive in practice when housed in its frame. The fire-resisting qualities are perfect, and the worst vibration cannot cause short-circuits.

Taps may be taken off at any part of the wire; the grooves, as a rule, support the terminal clips in a sufficiently rigid manner, and greater rigidity can be obtained by clamps on the cylinders. Repairs and adjustments on site are easily made with the minimum of disturbance to the resistance as a whole.

An oil-immersed resistance of this type leaves little to be desired.

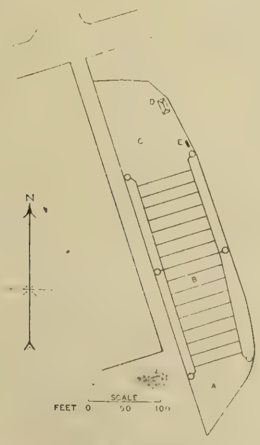
ELECTROCULTURE AT CHESTER.

We have received the following report on the electrocultural experiments carried out for the Corporation by Mr. S. E. Britton, city electrical engineer, Chester. The land, comprising 1·4 acres of pasture, was ploughed and trenched shortly after Easter, and arranged in three plots of, approximately, A, 970 sq. yards; B, 4,000 sq. yards; C, 1,800 sq. yards; the largest plot was equipped for electroculture, and lies between the two smaller plots.

For comparison, three varieties of potatoes were planted, and the following result was obtained:—

	Great Scot.	King Edward.	Summit.
Plot A—Natural Control—			
No. of roots	413	315	359
Average yield per root	1·363 lb.	·485 lb.	1·344 lb.
Plot C—Natural Control—			
No. of roots	—	238	398
Average yield per root	—	·567 lb.	1·497 lb.
Plot B—Electroculture—			
No. of roots	2,294	480	7,294
Average yield per root	1·684 lb.	1·231 lb.	1·451 lb.
	23·5 % inc.	153 % inc. & 117 % inc.	7·5 % inc. 3·1 % dec.

With regard to the Summits grown on Plot C, it should be noted that the supply wire from the shed to the discharge wire was passed over this ground, at a height of 8 ft.

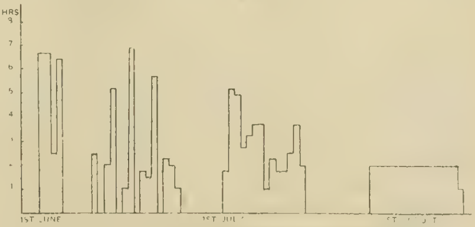


Plan of Ground.

A, C, control plots; B, electroculture plot; D, hut; E, earth plate.

Other vegetables were grown, but, owing to late planting, no attempt was made to obtain comparative result. Peas, beans, white turnips, swedes, and beet did well; carrots and onions were very poor, both in quality and quantity. Greens did well, and it was noticeable that those under electroculture were not attacked by caterpillar to the same extent as those under natural control, No manure or fertiliser was used.

The electrical equipment consisted of a 10-in. coil, with mercury break-current interrupter and Lodge valves, housed in a wooden shed, 25 yards from the plot, and an earth plate close to the plot. No. 30 S.W.G. galvanised steel wires were used for the discharge, placed 15 ft. apart and hooked to $\frac{7}{16}$-in. S.W.G. span wire attached to insulators, and the whole supported by six poles. To each of the poles was fixed a wrought-iron bar, which enabled the discharge wire to be placed at any distance from the ground between 2 ft. 6 in. and 6 ft. 6 in. The apparatus was supplied with 5 amperes at 210 volts D.C., which would maintain a spark ¾ in. long, when an earth wire was placed that distance from any part of the discharge network.



Hours during which Discharge was Used.

At the commencement the discharge wire was placed as near as possible to the ground, and, as the crop grew, raised to about 6 in. above the foliage. When climatic and other conditions allowed, the discharge was used from 6 a.m. to 8 a.m. and 6 p.m. to 8 p.m. daily, and during dull days between mid-day and 2 p.m. In all, the discharge was used for 122 hours, during which time 128 units were used, and the direction of the wind being from the south 16 per cent., south-east 23 per cent., south-west 42 per cent., and west 19 per cent.

This experiment indicates that it is not detrimental to place the discharge wire near to the plant, and that for experimental purposes and to obtain comparative results, it is not necessary to have the control plot several hundred yards distant from the plot under electrical treatment, as is the case when the discharge wire is placed 10 to 15 ft. above the crop.

Mr. Britton concludes that although the subject is a complex one, and at the present rate of progress it will take years to develop, the possibilities appear to be tremendous, and when it is better understood astounding results may be expected. It should, however, be made perfectly clear that its present state of development does not warrant its general application, and that there is yet to be evolved a more settled conception of the botanical effects and electrical requirements on which to base the practical work; therefore at the present time results should be treated as experimental. Probably the most useful progress would be made by encouraging electric supply undertakings in conjunction with plant physiologists to systematically experiment on small plots.

Early experiments demonstrated that the development of electroculture promised to produce results of vital importance, and having regard to what has been achieved in recent years it is astounding that the Government Departments concerned with these matters should be so inactive in utilising the suitable facilities which exist in many parts of the country for more speedy investigation of the problems associated with the use of electricity in producing increased crops.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Chief Engineers and their Remuneration.

I was greatly interested in reading your article affecting the award of Sir George Askwith in your issue of January 18th, pages 63 and 64, particularly your reference to chief engineers, especally as to "enriching themselves," "profiteering," &c.

I recall many articles in your valued journal dealing with the inadequate remuneration of chief engineers, considering their responsibilities and expensive training. Most of your readers will, I am certain, agree with me that such expressions referred to above, even when used in such an article as that referred to, are, to say the least of it, distinctly novel.

Years ago, long before war was even in sight, we were led to believe that the salaries of chief engineers would be revised in their favour, especially in undertakings municipally owned.

I do not intend to speculate upon or interfere in a matter which at the moment is *sub judice, i.e.*, if a war bonus is to be granted or to what extent, but I would merely point out that the Government, whom you justly blame for the unrest preceding the latest arbitration, have granted their officials a bonus of 10 per cent. whose salaries would come within that of the average chief engineer. What I want to emphasise, without regard to these bonus awards, is that the question of chief engineers' remuneration is much belated, a position not mitigated, but seriously aggravated, during the last three and a half years. During that period he has been forced to keep his undertaking going under exceptionally trying circumstances; his competent staff has dwindled through voluntary and compulsory enlistment; loans for repairs and extensions have been prohibited by law; repairs and renewals of plant deferred; and he has had to experience the nerve-racking ordeal of maintaining in commission overloaded and worn-out plant.

He is now confronted with the anomalous position that his chief assistant, having been granted increases and allowances arising out of war conditions, is receiving almost the same salary as himself, a salary which is recognised as hardly equal to that of a West End draper's assistant.

Those who have an intimate knowledge of modern practice in the supply and generation of electricity realise that it requires not only a knowledge of the latest scientific methods, but a sound business training, to produce the maximum result per lb. of coal, and secure the lowest total cost per unit sold. To such an extent do these results depend upon the zeal, skill, and activities of the chief engineer, that even if granted half as much again as his present salary, he could save it to his undertaking many times over in the 12 months.

It may be taken for granted that I hold no brief for this section of the industry, but in equity and fairness, and having regard to the overwhelming importance of the industry, which is foremost in national enterprise and development of kindred industries, then I feel that the proverb applies, "There is that withholdeth more than is meet, and it tendeth to poverty." If we are to develop our national resources as we hope to, and reap the collateral benefits which must accrue, then it follows as an elementary principle that we must attract the best men and the best brains, otherwise we can expect nothing but retrogression, a characteristic which in many respects is identified with our national temperament of *laissez faire*.

I make bold to say that there is neither rhyme nor reason why the whole position of salaries of chief engineers should not be considered forthwith, and dealt with on business lines, especially where the constant growth of undertakings under their control, and their corresponding responsibilities have progressed out of all proportion to their remuneration. Further than this I have nothing to say, except to leave it to the good sense of those responsible.

Duncan Watson.

London, W., *January 26th*, 1918.

[We are glad to see that Mr. Duncan Watson, chairman of committee of one of the most important Metropolitan municipal electrical undertakings, so fully appreciates the value of the services of chief electrical engineers; in this regard we are entirely at one with him, as our past record, to which he refers, amply demonstrates. Unfortunately he discusses the general case, to which the remarks which he criticises do not apply. We were careful to confine their scope to the case of engineers of *important* undertakings who were "already in receipt of salaries sufficient to meet their needs." Surely it is unnecessary to say that our comments, thus explicitly restricted, do not apply to those who do not fall within the limits thus defined; yet Mr. Watson discusses the case of a chief engineer in receipt of a salary "hardly equal to that of a West End draper's assistant"!

Not only did Sir George Askwith's award include the technical staff, but in an explanatory memorandum he said: "At least some of them whose status borders upon certain of the skilled men receiving the 12½ per cent. would be placed in an unfair position unless some consideration was given to them." The question how far this consideration should go, and which members of the staff it should include, was expressly stated to be a matter for the employers themselves to arrange, thus clearly indicating that he did not anticipate that it would go right up to the top in every case.

On reference to Mr. Faraday Proctor's memorandum, published on p. 85 of our last issue, it will be seen that attention is drawn to the course followed by large engineering firms which are paying the 12½ per cent. bonus to members of their staff receiving not more than £250 per annum, and bonuses from 12½ per cent. down to 10 per cent. on salaries up to £500 per annum. This appears to be a perfectly reasonable policy, to which no objection can be raised; and our remarks were not intended to apply to such cases, or to cases where in the ordinary course advances might legitimately be sought quite apart from the question of the 12½ per cent. award. That there are many chief engineers to whom increments of salary are undoubtedly due, and long overdue, cannot be questioned, and we sincerely hope that their merits will be recognised at no distant date.—Eds. Elec. Rev.]

Conversion of a Continuous System to Three-phase.

It would be interesting to have the opinions of correspondents on the best method of converting a continuous-current three-wire distribution system to three-phase supply, the pressure on the outers being, say, 460 volts. One cannot put the three-phase current on to the existing three conductors, as the mid-wire is naturally too small, and even if the conductors were of equal size, in practice it is necessary to run four wires for three-phase distribution. I believe the usual method in these cases is to take separate three-wire circuits from the L.T. transformers, balancing one street against another. It will be interesting to know from those who have experience how this works, and the best way to carry out the conversion.

Transformer.

Communication with Aircraft.

A paragraph under this heading appeared recently in the technical Press stating that a form of miniature searchlight operated by electricity and equipped with a telescope has been introduced recently by the French Army for signalling to aircraft. It may be of interest to your readers to know that this is not a very recent innovation, and, in fact, a similar apparatus was introduced by this company in October, 1915. The apparatus is known as the "Chapman Hand Signalling Lamp," and is fitted with a sighting tube and handle. A self-contained Morse key and dry battery are carried on a waistbelt and connected to the lamp by a flexible lead. The projector of the "Chapman" lamp is designed to give the maximum signalling range with a minimum angle of dispersion as viewed from a distant station.

The "Chapman" lamp is being successfully used for communication with moving objects, *e.g.*, between aircraft and earth, or vessels in or approaching harbour, where the need for secrecy precludes the use of non-directional masthead lights. The entire equipment is extremely portable and light, weighing 3½ lb. only.

Graham & Latham, Ltd.
Lionel J. Graham, *Director.*

London, S.W., *January 22nd*, 1918.

Faults.

Mr. Hutchison's article in your issue of January 18th bears out the view I have always advanced, that good results in localising faults can be obtained even with the simplest possible appliances, the use of which does not require special qualifications or a high degree of manipulative skill. But it is disconcerting to read in his prefatory note that "really practical information on the subject is not easily obtainable." The methods he describes have been in use in practice for over 20 years. Thousands of faults in electric light and power mains have been localised with their aid, and the experience of the people who have done this has been described by them in at least a score of articles, and three consecutive editions of a book on the subject.

The only new things in Mr. Hutchison's article are certain details as to the execution of the tests, which, unfortunately, are open to criticism. He imposes unnecessary limitations on the application of the loop test. The bank of ten 25-C.P. carbon lamps which, he says, is to decide whether a loop test is to be used or not, will (assuming the voltage to be 200) have a resistance of about 50 ohms when hot, and a much greater resistance when cold, so that they will not glow unless the fault has a very low resistance. When the megger sails over to zero, and his bank of lamps yet won't glow, the obvious thing to do is to carry on with the loop test, putting a fuse in place of the lamps. My advice is always to use the loop test when you can get an undamaged cable or core as return, unless the resistance of the fault is so high that it can't be done with the galvanometer available.

The fall of potential test he describes, with the fault (and its back E.M.F.) in the galvanometer circuit, is far less accurate, and should only be used for faults of really high resistance. Then, however, it is quite wrong to limit the current to .4 ampere, as he does, because the bigger the voltage drop over the fault and galvanometer circuit, the less will be the inaccuracy due to his "earth readings." But, even without this source of error, it is obvious that in the example he describes, in which the result is worked out from readings of 19 and 26.5, his accuracy of localisation to 0.16 per cent. (I *did* enjoy that last six when I read the article) was the merest possible chance.

Incidentally, I may mention that Mr. Hutchison's abbreviation F.P. cannot be adopted for his purpose, as it has already been allocated to a totally different procedure occasionally used in war-time; admittedly, there is a parallel, for F.P., whether No. 1 or No. 2, should only be resorted to when a fault cannot be adequately dealt with by other means.

Lastly, the empirical deduction of 3 per cent. of the calculated distance, to allow for the copper burnt away near the fault, is too ridiculous. Why should an earth 300 ft. off burn away 30 times as much of the cable "near the fault" as one only 10 ft distant?

F. Charles Raphael.

B.E.F., France, *January 25th*, 1918.

[Lieut. Raphael's modesty forbids him to mention that he is the author of the standard work on this subject, viz., "Localisation of Faults in Electric Light and Power Mains." —Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Tramway Relay-Operated Contactor.

In an article in the *Commonwealth Engineer*, by Mr. Robertson, engineer and manager of the Melbourne, Brunswick & Coburg Tramways, a new type of radial truck car which is being introduced into service is described. The electrical equipment possesses some novel features. Two 55-h.p., 600-volt, box-frame, self-ventilating type motors are employed, and the control arrangement is such as to avoid interruption of current in the controller.

The main circuit is made by a relay-operated contactor under the car. In cutting off, the initial movement of the controller backwards, at any point, opens the contactor relay circuit, and the main current is interrupted by the contactor. It is hoped that this innovation will cut down controller maintenance to a minimum, and prevent any danger of fire on the motorman's platform. The contactor replaces the automatic feature of the canopy switches, so that there is only one of these which acts simply as a main switch, and not as a circuit breaker; in addition, there are two small relay switches, one at each end of the car. The arrangement is shown diagrammatically in fig. 1.

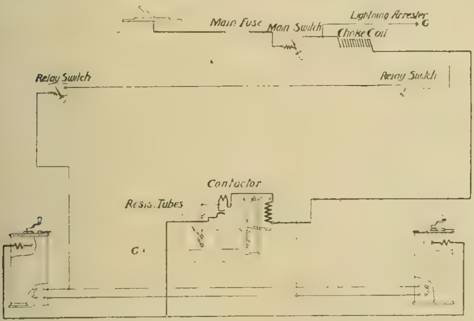


Fig. 1.—Connections of Contactor.

Automatic Electric Shell-Heating Furnaces.

The automatic electric furnace equipment for heat treating shells shown in fig. 2 is an adaptation of furnaces of similar size that have for years been used for the heat treatment of steel parts for railway and motor-car equipment. It consists essentially of two furnaces, the quenching mechanism, and the automatic control apparatus, by means of which all operations, or movements, of shells are accurately timed and executed.

The final control of the movements of the shells is centred in several contact-making pyrometers. They are so adjusted and calibrated that when the shells in the discharge part of the first furnace have reached their temperature and soaked for a predetermined time to ensure their being heated through, the special pyrometer controlling that furnace closes contacts, thus setting in motion, through a radial dial switch, the various motor control valves for pushing in a new row of shells, simultaneously discharging the fully heated shells, and allowing them to clear the furnace and drop into the quench. At the same time the pusher of the furnace is backed out and the doors are closed. Meanwhile, the shells that have just dropped into the quenching mechanism have commenced to rotate, and the spraying water is turned on and allowed to flow for a definite interval, which, in turn, is controlled by a motor-operated time element on the automatic control. At the end of this time period the water is automatically shut off, and the shells just quenched are moved up by forks in each shell nose connected to the long radial arm. This arm delivers the entire row of shells in front of the pusher of the second furnace, and then returns to its position of rest at the bottom of the quenching mechanism, ready to receive the next lot of shells to be quenched. When the shells in the second, or drawing, furnace are fully heated to the required temperature, a similar operation takes place, wherein the shells that have just been received from the quenching mechanism are pushed into the second furnace, in turn pushing out the shells in the discharge end under the contact-making pyrometer tubes, which have by this time reached the temperature to actuate this equipment.

The illustrations show the size of an equipment used for heat-treating 45 8-in. American high-explosive shells per hour, which is equivalent to 3½ tons per hour of any other size of shells, shrapnel or high-explosive.

The principal advantage of these electric furnace equipments over the ordinary types of furnace is greater precision and certainty in obtaining the required temperatures and quenching conditions. The human element is entirely eliminated, with the exception of placing the shells to be treated on the charging platform of the first furnace, subsequent operations being controlled by the automatic part of the equipment.

Other advantages are the great saving of labour, and reliability; it is a common thing for an equipment of this character to operate continuously for six or eight months at full capacity without an hour's delay.

These automatic furnaces are built by the Electric Furnace Co., Alliance, Ohio.—*American Machinist.*

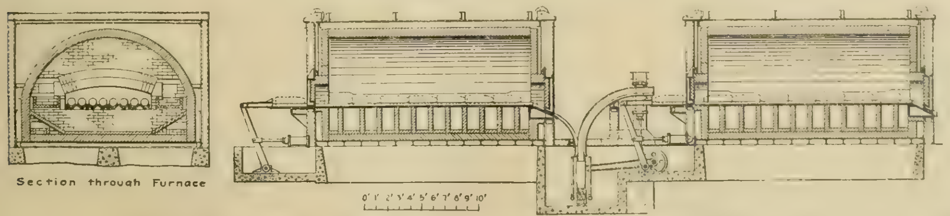


Fig. 2.—Transverse and Longitudinal Sections of Automatic Furnace Equipment.

A New Bulkhead Fitting.

As an instance of the scope that exists for the improvement of apparatus which has been for years accepted as standard, and as such not open to improvement, the Wilkinson patent bulkhead fitting is an interesting example. Since the days of the earliest carbon lamps one has been accustomed to the regulation bulkhead fitting, and no one seems to have thought it necessary to improve it. However, the great developments that have taken place in lamps and wiring methods have led to a complete re-design to put the bulkhead fitting into line with modern requirements.

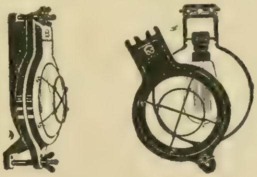


Fig. 3.—Wilkinson Patent Bulkhead Fitting, No. 610, Closed and Open.

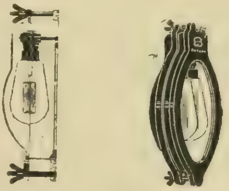


Fig. 4. Fitting No. 614, for use Outside "Danger Buildings."

The principal features claimed for the new design are facility of installation, easy wiring—looping-in in particular—centralisation of the filament, no hinges to corrode, easy removal of the lid without dropping it, and (in two of the types) the facility to use either one or two 40 or 60-watt lamps at will.

The holders (either one or two) are fixed by the shade ring in a plate sliding in the grooved sides of the case. The holders and plate can be removed for wiring, and the position of the plate varied to centralise the filament in the reflector. There are no small nipples. Ample space is allowed for slack wire.

The lid is removed by slackening the wing nuts, without removing them. Two fixing screw holes only, both in the centre line, reduce wall plugging; fixing on a narrow pillar is simple.

The fittings are particularly suitable for ship use and chemical works. A special pattern, fig. 4, is made for use in, or rather, outside danger buildings, to project the light through the window, the door being at the back, so that the lamp may be renewed without disturbing the fitting itself.

The sole makers are the **Wardle Engineering Co., Ltd.**, 196, Deansgate, Manchester, and 25, Victoria Street, London, S.W. 1.

A Lamp-Locking Device.

According to *The Electrical Trades Journal*, Mr. W. Stewart, of the Sydney City Council's meter staff, has patented and put on the market an ingenious keyless lamp lock. The act of turning the lamp causes the locking band to revolve, at the same time the locking pins ride round on the outside of the lampholder till they reach the slots, when they immediately snap into position, automatically preventing the lamp from being withdrawn. Before a burnt-out lamp can be removed it is necessary to break the glass. The locking spring can then be taken out, allowing the butt of the lamp to be withdrawn and a new lamp inserted as before. When a thief wishes to steal a lamp but finds he has to break it to get it, his object is defeated.

THE FARADAY SOCIETY.

The Setting of Cements and Plasters.

On January 14th the Faraday Society inaugurated the New Year's work with a general discussion on "The Setting of Cements and Plasters," to which the members of the Concrete Institute had also been invited.

Mr. James Swinburne, F.R.S., Past-President, made the interesting announcement from the chair that the discussion was intended to provide a survey of the present position of our knowledge of a very fascinating corner of applied physical chemistry, which it was hoped would be helpful in indicating the best lines of attack in an experimental research the Society intended to initiate after the war.

Dr. C. H. Desch, of Glasgow University, one of the few men outside America and France who have given attention to the chemistry of cements, was chosen by the Council to open the discussion, and in his paper the rival theories of setting at present held were clearly stated and judiciously examined. The simple case of the setting of plaster of Paris and similar cements would appear to be well understood. It arises from the formation on hydration of the compound $2\,\mathrm{Ca\,SO_4\,H_2O}$ which is readily soluble in water, but from a super-saturated solution of which the dihydrate $\mathrm{Ca\,SO_4\,2\,H_2O}$ crystallises out around any nuclei of that hydrate which may happen to be present in the mass, precipitating in radial crystals that interlock, and so produce a mass possessing considerable mechanical strength. Possibly a transformation of crystalline form also occurs—an hypothesis necessitated by the known expansion of plaster in setting. This "crystalline" theory was first put forward by Le Chatelier, who vigorously defended its application to cements as well as plasters in a paper contributed to the discussion. For it happens that even in plaster of Paris no crystals are visible under the microscope when first it sets, although in course of time obvious crystals certainly develop. This has suggested the "colloidal" theory of setting due to Michaelis.

Let us in the first place, however, consider our present knowledge of the constitution of Portland cement, as set out in the papers sent by Mr. A. A. Klein, late of the U.S.A. Bureau of Standards, and Mr. G. A. Rankin, of the Geophysical Laboratory, Washington, where a brilliant series of researches in these and cognate matters has for many years been carried out. The clinker from which Portland cement is made is a result of the chemical combinations brought about by burning at temperatures reaching to 1,650 deg. C. for the best brands, of a particular mixture of the oxides lime (CaO), alumina ($\mathrm{Al_2\,O_3}$), and silica ($\mathrm{Si\,O_2}$). Other component oxides, those of magnesia and iron, are of secondary importance. It has now been acceptably proved that the essential components of the resulting clinker are tricalcium silicate ($\mathrm{3CaO,\ SiO_2}$), tricalcium aluminate ($\mathrm{3\,CaO,\ Al_2\,O_3}$), and the so-called beta modification of calcium orthosilicate ($\mathrm{2CaO,\ SiO_2}$). If the mixture is underburnt, free lime and other unessential constituents are also present.

The experimental study of the hydration of these separate constituents of Portland cement clinker has been carried out at the Washington Bureau of Standards. From this work it appears that the initial set in Portland cement is due to the hydration of the tricalcium aluminate, but the essence of the process—the reaction which gives to the cement its characteristic hardness and strength—is the hydration of the tricalcium silicate, which, making up 30 to 35 per cent. of a normal cement, is its most valuable constituent. Now what happens when water is added to tricalcium silicate is not the formation of a definite hydrated salt, but the separation of the lime and the silica, and the release of a gelatinous form of hydrated silica. In the complete cement this gelatinous silica forms round the individual grains and cements them together.

Such is the "colloidal" theory of setting in its most recent form, and it would appear to be directly opposed to Le Chatelier's conception of a mass of interlocking crystals. Dr. Desch attempted to harmonise the two views by means of Weimarn's theory that the passage from the crystalline to the colloidal state is a continuous one, the latter simply being a condition in which surface forces are all-important. It is certainly a fact that in cement, as in plaster, crystals visible under the microscope appear in course of time, but this fact may be used to support either view. The analogy with ammonium nitrate, copper sulphate, and other crystalline salts having a tendency to set into a solid mass under certain conditions, which was pointed out by Dr. J. M. Lowry and Mr. F. C. Hemmings, does not necessarily apply to every case of setting. Dr. W. Rosenhain, in a very suggestive contribution to the discussion, wished to generalise the phenomena by including the "setting" of metals which was caused by crystal-adhesion due to the presence of a film of undercooled amorphous material between the crystals. We are not convinced that the matter at issue is one of words only, as Dr. Desch thinks, and for the time being the problem must be considered to be unsolved—with, perhaps, a bias on the side of the "colloidal" advocates.

Further investigations are obviously called for, and these will doubtless yield results of practical as well as theoretical value. In the meantime, an ever-present problem for the engineer, the builder, and the architect is how to improve the setting qualities of his cement. If tricalcium silicate is the most valuable constituent, why not increase the percentage of that compound? The answer is that too high a burning temperature would be required, and economic considerations at present stand in the way. But it may be possible to find some fresh constituent—call it a catalyst, if you like—in the presence of which gelatinous silica will be readily released from dicalcium silicate, as well as from the tricalcium salt, and this line of research, indicated by Mr. Rankin, is one that will no doubt emerge as a result of the discussion.

Several interesting papers of a more immediate practical character were also contributed. Mr. W. J. Dibdin, speaking on "Ancient and Modern Mortars," showed that, although many old mortars were of exceptional strength, it was only the modern rush for economy, by reducing the quantity of lime, that was responsible for the falling-off in quality. On the theoretical side, his examinations proved that soluble silicates were not formed in course of time, and, as to the setting of mortar, he agreed with Graham's view that it was due to the formation of a solid hydrate like gypsum.

Mr. Deny and Mr. E. H. Lewis described the effect on the setting properties of Portland cement of adding suitable slags, and they showed that using also limestone, and properly granulating the slag, excellent results could be obtained. The matter is obviously one for both blast-furnace owners and cement makers seriously to consider. Mr. Percy C. H. West reviewed the history of this subject, which in Germany has been the occasion of a good deal of controversy. Mr. Bertram Blount's careful contribution spoke on modes of determining the setting of cement and concrete—another aspect of the subject calling for investigation and standardisation—and finally the architect's point of view was admirably stated by Mr. W. D. Calve, who has been concerned with the question of the stability of St. Paul's Cathedral, and who gave practical illustrations of the value of a scientific treatment of problems connected with cement and concrete. Mr. A. Binns similarly voiced the standpoint of the constructional engineer, and he and Mr. W. J. Cooper laid down the proper conditions under which setting should take place in practice.

The discussion as a whole was both informative, stimulating, and suggestive, and the bringing together of manufacturer, engineer, architect, and chemist to talk over matters of common interest was in itself an end that justified the organisation of the meeting.

The Electrolytic Pickling of Steel.—Experiments were carried out by Messrs. M. de Kay Thompson and F. W. Dodson, at the Massachusetts Institute of Technology recently, on black sheet-iron, samples of which were pickled in hot acid 4·5 per cent. by weight, and by electrolysis in sulphuric acid of specific gravity 1·19 with lead anodes. The electrolytic process left the surface silvery white and very clean: the chemical process left it not so clean, but covered with fine black particles, which could be removed by rubbing and washing. The current density employed was from 0·033 to 0·058 amp. per cm.^{2} and the pressure 2·68 to 2·90 volts. The temperature of the solution was 60° C., and the time occupied was 2 to 5¼ minutes. In the chemical process the temperature of the bath was about 100° C., and the time 3 to 8 minutes. The amount of iron dissolved was 0·0032 gm. per cm.^{2} by electrolysis, and 0·00386 gm. per cm.^{2} by chemical pickling; in the former case the scale was not lost but was reduced, whereas in the latter case the scale fell off and was lost. Besides the small economy of iron and acid resulting from the electrolytic process, the surface obtained was much better, and the acid was at a lower temperature and therefore less injurious to the workmen.

PROBLEMS OF INDUSTRY.

If it be true that in the multitude of counsellors there is wisdom, then we ought to be well prepared, in theory, at any rate, for the vast problems of labour and industry that inevitably arise from the revolution that has been working its way in our midst during the last three and a-half years. The guillotine has not been erected in public places, nor have rivers of blood flowed down our thoroughfares; but the guillotine has, nevertheless, been ruthlessly at work in the minds of men, lopping off old ideas, and along the byways to oblivion there has been flowing a stream of obstinately-held prejudices that were nursed in former times. If we are wise, we shall be content to have it so, for, platitude though it be, "things never will be the same again" in industry or, indeed, in much else. We cautiously say "much" else, because if there is one thing that is less altered than any other, it is that old Adam that is within us all, employed and employer alike. 'Twere blindness only that could fail to see that the old jealousy for individual self-interest in industrial life remains as deeply entrenched as ever in our nature. Perhaps the acute necessities of war-time have established it there more strongly than before; but, whatever the cause, there it is, and there it is likely to remain until hardships are removed or we are more potently influenced by higher ideals. There is little reason to anticipate an early removal of hardships—the simplest soul should be able to see that; but what of the influence of higher ideals in shaping the relationships of the coming days in industry? Since the publication of an earlier series of articles*, we have read much literature upon the industrial world that is to be. Experts are as numerous as the sands of the shore, who are able to tell of this, that, and the other measure that will provide a panacea for all the evils that will accrue from the war either as the direct results of industrial change or from the revolution that has been working, sometimes silently, sometimes otherwise, in our thinking. Some speakers of note have confined themselves to generalities, such as the need for better relations on "both sides," the employé to abandon his obstructive limitation practices in exchange for better wages, better housing, shorter hours, and generally improved conditions of life. Others have held that if we can only assure abundance of trade and plenty of employment, things may be relied upon to find their level again in the course of time. Others have planned special organisations which they would fain apply to industry, as though it were starting *de novo*. The Government has recommended Industrial Councils on the Whitley principles. And so on. But there are yet others who think that, in addition to a better understanding between Capital and Labour, the abandonment of old reprehensible practices, the cultivation of enormous volumes of trade, the elaboration of great organisations, and the setting up of Whitley Councils to secure the aforesaid better understanding in perpetuity, we have a pressing need for high ideals on "both sides," calling for a crucifixion of that old Adam to which we have referred already.

There never has been any shortage of cranks or faddists, or idealists, in this country, or in Europe generally, in modern times. Any departure from established lines of thought would readily bring such an appellation from the lips of the severely practical man, but we cannot with reason apply such terms in days like these, when the industrial atmosphere has undergone so remarkable a change, when new measures and new ideas are needed for new times and new conditions. Old conceptions can hardly be consigned to the scrap heap without new ones taking their place. Therefore, it is incumbent upon us to give a patient and generous hearing to those who dare to cut new ground and express themselves with originality and foresight concerning ways and means for securing a safe future for the nation and its industries. The idealists of one age have sometimes proved to the next generation that they were saner guides than the experts who contemptuously put their views aside. Yet we must make this reservation here, that time presses and we cannot afford to waste it upon mere dreams, if we are going to make ready early for the industrial situation that after-war upheavals will almost inevitably promote. The fact remains, however, that no superficial ready-made remedy is likely to be sufficient to the new situation. It may be found in the Whitley principle which involves so much in the matter of efficient organisation of trades preliminary to conference on points of disagreement; it may lie in increased efficiency and bigger productivity; it may lie partly in business organisation; it may be that parts of the recently issued Labour programme will furnish the way to peace and prosperity for all. But we need to go even further than all of these—deep down to fundamentals. Sometimes fundamentals and idealistic theories become confused, and it is, therefore, essential that we face such problems as confront us to-day with great care and discrimination.

We have before us a copy of the Watt Anniversary Lecture delivered by Mr. W. L. Hichens* at Greenock last month. Now, if we had not known that Mr. Hichens was a leader in an important industry, and therefore constantly up against the hard facts of practical industrial life as the chairman of Messrs. Cammell, Laird & Co., Ltd., we might have imagined, from parts of the discourse, that he was an idealist pure and simple, anxious to turn work into one long well-paid summer holiday, or was looking out upon industry as some clergymen do from the pulpit, quite oblivious of its nature and its difficulties.

But taking the address as a whole, we say convincedly that there is nothing impractical or idealistic about what he says, for there are clear evidences in almost every page that show that he is fully in touch with the movements of the hour, and is as alive to the actual emergent realities as any coldly calculating business organiser. When we find, therefore, that in considering the problems of modern industry he gets right down to the bases of human society—"Love of God and love of man"—as the final motives of all right conduct we find ourselves in full accord, and welcome this recognition of a matter far too often ignored in our controversies concerning industrial questions, and far too frequently lost sight of in discussing educational questions, as "Radix" pointed out in his recent serial in our pages. Without the bases referred to, says Mr. Hichens, "all societies crumble, and the world becomes the pandemonium that it is to-day." If we are a Christian nation, we should apply the principles of the religion that that name implies in our respective positions of employers and employed. The worker should not render shortened service, or the shopkeeper short weight, nor should the employer strive hard in order that he may pay no more than he is "compelled," or the purchaser pass bad coin or fail to pay his debts. These may be considered idle moralisings, but they are typical of what we believe Mr. Hichens has in mind, and we believe that if such principles were more generally adopted on "both sides," we should more readily find the way to industrial harmony, security, and prosperity than we shall do by some other means. The author sees no reason for discarding ideals in the practical affairs in life. "No sensible man would suggest, moreover, that all opportunity for individual profit should be taken away by legislation. To destroy the existing incentive without putting something in its place is merely to leave the chamber of men's minds a prey to seven devils worse than the first. Legislation cannot make belief; these must be determined by each individual conscience for itself, and legislation can only express what the public conscience has already accepted." Mr. Hichens sees that industry should be really recognised as primarily a national service in which each individual is fulfilling his function to the best of his ability for the sake of the community in which private gain is subordinated to public good. "If each man thinks of making his pile by all the means that economic individualism allows, if class bands itself against class, Trade Union against employers' federation, firm against firm, to secure the greatest share of the world's goods in unrestricted competition, social life must inevitably break down, and anarchy reign supreme." It is in order that we may avoid that breakdown and anarchy, when we have finished with the war, that Whitley Councils and organised association movements are designed, but they will neither of them succeed to the full unless they have some of the spirit of the higher idealism running through them.

(To be continued.)

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* "Labour and Industry." Elec. Rev., May and June, 1916.

* "Some Problems of Modern Industry," Greenock Philosophical Society, January 18th, 1918.

WAR ITEMS.

One-Man Businesses.—In pursuance of its intention to encourage co-operation so as to safeguard the interests of owners of one-man businesses who are called to the Colours, the Director of National Service has appointed several well-known men to assist his Department in the matter. Among these is Mr. J. G. Wilson, Secretary of the National Federation of One-Man Business Associations, who is appointed a Temporary Officer of the Ministry.

Schedule of Protected Occupations.—The revised Schedule of Protected Occupations will come into force on February 1st. It renders available for recruitment all men medically classified fit for general service (Grade I), who had not attained the age of 23 by January 1st, 1917, whatever their occupation or the work upon which they are engaged, with the exception of certain classes of men engaged on hull construction and repair. A higher age has been fixed in certain occupations below which Grade I men will be recruited. Men of military age engaged on Admiralty, War Office, or munitions work, or in a railway workshop, whose occupation is not scheduled, are not entitled to protection on occupational grounds if they are medically classified Grade I.

Westinghouse War Fund.—We have received a copy of the statement of receipts and payments to the British Westinghouse Employés' War Relief Fund from August 22nd, 1914, to December 31st, 1917. The total contributions to the fund during that period have been £50,008, £33,417 from the employés and £16,591 from the company. The out-payments have amounted to £31,740 paid to dependents, while £12,031 has been set aside for a Disablement and Dependents' Fund, and £2,479 has been spent in donations to local and national funds and Christmas gifts. The number of British Westinghouse employés who have joined the Forces is 3,100, and we regret to learn that the casualties have been exceedingly high. The number of families in receipt of weekly relief is 757.

New War Committees.—We welcome the announcement that the Minister of Reconstruction has appointed the following committee of manufacturers and business men to consider the provision of new industries for the engineering trades:—

Hon. H. D. McLaren, M.P., C.B.E. (chairman).
Mr. Charles Bennion (British United Shoe Machinery Co.).
Sir George Bullough, Bt. (Howard & Bullough).
Mr. F. H. Crittall (Crittall Manufacturing Co.).
Mr. R. Dumas (British Thomson-Houston Co.).
Mr. W. B. Lang (John Lang & Sons).
Mr. C. A. Lister (R. A. Lister & Co.).
Mr. P. J. Pybus (Phœnix Dynamo Manufacturing Co.).
Mr. G. H. Sankey (Joseph Sankey & Sons, Ltd.).
Mr. Percy Stothert, K.B.E. (Stothert & Pitt).
Mr. J. Taylor (Mather & Platt).
Mr. W. Taylor (Taylor, Taylor & Hobson).
Mr. W. Thom (Yates & Thom).
Sir W. Rowan Thomson, K.B.E. (David Rowan & Co.)

The duties of the new Committee will be to compile a list of the articles suitable for manufacture by British engineers which were either not made in the United Kingdom or were made in insufficient quantities, and for which there is likely to be a demand after the war. The list is to be classified in three groups: Articles that can be made (1) by women, (2) by men and women, (3) by skilled men, and is to show the industries to which such new manufactures could most suitably be attached. According to the *Daily Telegraph* the Committee is also to make recommendations as to the establishment and development of these new industries by the transfer of labour or machines or by other measures; also, as to how such transfer could best be made, and what organisation would be needed for the purpose, with due regard to securing the co-operation of labour. To give help on this side of the work, a Labour Advisory Panel is being formed, consisting of representatives of skilled, semi-skilled, and unskilled workers, and of women. With this panel the Committee will work in co-operation on questions concerning labour.

The War Priorities Committee appointed some time ago by the War Cabinet to decide questions of priority of manufacture in their bearing on the conduct of the war, is composed of the following:—Lieut.-Gen. Smuts (Chairman), the First Lord of the Admiralty, the Secretary of State for War, the Minister of Munitions, the Minister of National Service, the Air Minister.

In order that the requirements of the public services, such as transport, light, heat, power, &c., may receive proper consideration, a General Services Committee has been appointed by the War Priorities Committee, under the chairmanship of Mr. John Wormald, M.Inst.C.E., with representatives from the Ministry of Munitions, Admiralty, War Office, Board of Trade, and Local Government Board. This committee considers the requirements of these services, and formulates on their behalf demands which are taken into account by the War Priorities Committee in their allocation of the available supplies of the various commodities. The chairman of this committee is assisted by an Advisory Committee, whose particular duty it is to inquire into the needs of the various general industries, the maintenance of which is not vital to the supply of war material or to the life of the community, but which it is desirable to preserve, if such preservation can be secured without sacrificing interests deemed essential to the successful prosecution of the war. The composition of this Advisory Committee is as under:—

Mr. George E. Alexander.
Mr. Kenneth Chance.
Sir Archibald Denny, Bart.
Mr. Alexander Walker.
Mr. Henry Woodall, M.Inst.C.E.
A representative of the Board of Trade.

The Secretary of the War Priorities Committee is Colonel F. J. Byrne, C.M.G., with offices at 11, Pall Mall, S.W. Applications for priority certificates and permits should continue to be sent to the Priority Departments of the Admiralty and Ministry of Munitions.—*Daily Telegraph.*

Exemption Applications.—At Hull, on January 21st, the city tramway engineer (Mr. J. Wilkinson) applied for exemption for two men, one the driver of the tower wagon (41, Class A), and the other the driver of the rail grinding machine (33, B 1). He said that the retention of the men was necessary in the public interest. Each man was given conditional exemption.

The Coalville Tribunal has granted a final month's exemption to the electric light attendant at Charnwood Towers, aged 40.

At Nuneaton, exemption was claimed by P. Howe (29), electrical engineer, who said that he had a large connection, keeping electrical machinery and appliances going. He was given until June 30th.

Kendal Tribunal heard a National Service appeal against conditional exemption granted to a switchboard attendant (B 4, Grade 3) at the Corporation electricity works. The certificate was substituted by temporary exemption until May 15th.

At Derby, before the County Tribunal, the Derby Lamp Co., metal-filament lamp manufacturers, Derby, appealed for the only male employé left (42, Grade 3). He was given conditional exemption and relieved of Volunteer service.

At Oxford, the National Service Representative appealed against two months' exemption granted to T. Smalley (32, B 1), inspector, and V. Hill (35, B 1), driver, with the Oxford Electric Tramways Co., Ltd. Mr. W. B. Cownie, managing director, said that both men had had considerable experience in technical repairs. They attended to breakdowns, and took the place of drivers. They had made efforts to get substitutes, but without success. The Court dismissed the appeals, and confirmed the exemption.

LEGAL.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

On the 24th ult., the appeal by the British Thomson-Houston Co., Ltd., from an order of the Court of Appeal (dated March 20th, 1917), affirming a judgment of Mr. Justice Astbury in favour of the respondents Duram, Ltd., was commenced in the House of Lords.

The House consisted of the Lord Chancellor (Lord Finlay), Lords Dunedin, Atkinson, and Shaw.

Mr. Walter, K.C., Mr. Colefax, K.C., and Mr. Gray appeared in support of the appeal; Mr. T. Terrell, K.C., Mr. D. M. Kerby, K.C., and Mr. Courtney Terrell for the respondent company.

The proceedings at the Court of Appeal were reported in our issues of March 16th and 30th, 1917.

Mr. Walter, K.C., in the course of his opening, said the appellants were the plaintiffs, and they sought in the action an injunction to restrain the respondents from infringing Letters Patent No. 21,513* of 1906, granted the appellants for an invention entitled "Process and apparatus for the treatment of metallic tungsten and for the manufacture of metallic filaments therefrom," and Letters Patent No. 17,722 of 1911, granted to John Thomas Henry Dempster for an invention entitled "Improvements in methods of wire drawing," for an inquiry as to damages and usual consequential relief. The trial of the issue of infringement was postponed by consent until the validity of the patents was decided. One patent was held invalid for want of subject matter, the other invalid by reason of prior user. Consequently, the action on both grounds of claim was dismissed. The Court of Appeal affirmed the decision of the trial Judge, and this appeal from that order was brought as to the validity of the 1906 patent only, there being at present no appeal as to the decision on the earlier patent of 1911.

Lord Dunedin: Then the substantial question in this House is the validity of the patent.

Mr. Walter replied that that was so.

Mr. Walter, in opening the case, dealt with the history of the subject, and on the following day addressed himself to the specification on which the appellants' patent rested. The appellants' invention consisted in the discovery that a mere built-up body of particles of tungsten could be sufficiently consolidated together by prolonged heating below the melting point, and could then, if worked hot, be treated as though it were a solid piece of metal, and continuous lengths of wire of filament size could be produced therefrom. Counsel described the process in detail, and said that the main ground on which the respondents alleged that the appellants' patent was invalid was want of novelty and subject-matter.

On Monday last the hearing was continued.

Mr. Walter said that the appellants submitted from the first that Moissan's publications disclosed no practical method of producing pure tungsten in a dense coherent form, and were merely a record of experiments which had not assisted in any manner the working of tungsten. There was no evidence before Mr. Justice Astbury that at the date of the trial anyone had succeeded in obtaining a workable body of molten tungsten.

Lord Dunedin: What do you say the learned judge wrongly held to be a ground for dismissing the action?

Mr. Walter: There was no evidence on which he could hold that the appellants' patent was invalid on the ground that the first claim of the specification disclosed no subject-matter, in that it covered the working of fused tungsten while hot, and that the working of a fused metal hot was merely the utilisation of the common tools and routine of the metal worker, and was not the subject of invention at all.

The learned counsel then dealt with the evidence. The hearing was continued during the week.

(To be continued.)

BUSINESS NOTES.

Disposal of A.E.G. Stocks in Australia.—H.M. Trade Commissioner in Australia writes that after the outbreak of the war the Australian Metal Co., Ltd., which was the agent in the Commonwealth for the A.E.G., the well-known German electrical concern, was declared to be an enemy company, and the considerable stocks held in Australia were taken over by the Controller. It has now been decided to dispose of these stocks, and a priced catalogue of the various goods offered for sale has been issued by the Australian Director of Munitions. It is not proposed to dispose of the stocks by public auction, but to realise them gradually, and it is understood that the proceeds will be deposited with the Public Trustee in the Commonwealth. H.M. Trade Commissioner has forwarded a copy of the catalogue referred to, which will serve to indicate to British manufacturers of electrical appliances and machinery the nature of the goods stocked by the German company. The catalogue may be consulted by British firms interested in the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).—*B. of T. Journal.*

French Thomson-Houston Developments.—It is stated that the directors of the Compagnie Francaise Thomson-Houston and of the Eclairage Electrique have decided to amalgamate the two undertakings by the former absorbing the latter, which would be liquidated and its assets paid for by the issue of new Thomson-Houston shares. Immediately after this augmentation of capital it is proposed to make a further emission in order to proceed with the large programme in view, comprising the development of the electrical industry, particularly in relation to the electrification of railways. The present capital of the Thomson-Houston Co. is £2,400,000, and would be expanded to £4,800,000 by the two issues in contemplation. The Eclairage Electrique has largely extended its works during recent years, and its manufactures are partly complementary to those of the absorbing company, which is said to be the leading manufacturing company of its kind in France.

Book Notices.—The issue of *la Revue Generale de l'Electricité* for January 5th contained an editorial note by M. J. Blondin, reviewing the progress of the journal during its first year of existence in its present form, with pardonable pride. We have much pleasure in offering to our excellent contemporary our congratulations on its successful accomplishment of an ambitious and formidable programme, in the teeth of the numerous difficulties which beset all technical periodicals in these days, and we hope it will continue to prosper, under the guidance of its new editor-in-chief, M. Alfred Soulier.

"Annuaire pour l'An, 1918." Paris: Gauthier-Villars et Cie. Price 2 fr.—Besides the usual tables, the Annuaire this year contains articles on "Time at Sea," by J. Renaud; and "The Sun and Terrestrial Magnetism," by M. Hamy.

"The Practical Electrician's Pocket-Book and Diary for 1918." By H. T. Crewe. London: S. Rentell & Co. Price 1s. 6d. net.

"*Proceedings* of the Physical Society of London." Vol. XXX. Part 1. December 15th, 1917. Fleetway Press, Ltd. Price 4s. net.

"B.E.A.M.A. *Journal.*" Vol. IV, No. 1. January, 1918. London: Oakley House, Bloomsbury Street, W.C. 2. Price 1s. net.

"The Post Office Electrical Engineers' *Journal.*" Vol. X, Part 4. Jan., 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"The Great Debenture: or the Passing of National Unrest." By Cecil Watson. Glasgow: Maclure, Macdonald & Co. Price 1s. net.

Catalogues and Lists.—Messrs. W. T. Henley's Telegraph Works Co., Ltd, Blomfield Street, London Wall, London, E.C. 2.—Two new lists; one (No. U E 0,201), is a 16-page illustrated pamphlet giving tabulated particulars and prices and jointing instructions relating to their indoor wall type vertical terminal boxes. The second list consists of 32 pages, published in French, giving full details of a new range of straight-through and branch boxes for all pressures up to 24,000 volts. In the course of a few weeks a Spanish edition of this list will be issued.

Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—Illustrated priced leaflet (Catalogue Section "A"), describing a new type of bulkhead fitting (the Wilkinson).

Calendar.—The Victoria Electric Plant Co., of Spencer Street, Victoria Street, Westminster, S.W. 1, have prepared an artistic wall calendar for 1918 with a charming hand-painted water colour view, "Fast Falls the Eventide."

Trade Announcements.—Messrs. Bill & [illegible] have removed from Great Charles Street to 18-26, Constitution Hill, Birmingham.

The London offices of Messrs. J. Hopkinson & Co., Ltd., have been taken over by the Government, and their address is now Hastings House, Norfolk Street, Strand, W.C. 2. Telephone: No. 3460 Central. Telegraph: "Valvestem, 'Phone, London."

The A.S.E.—The new central premises of the Amalgamated Society of Engineers, in Grosvenor Street, Manchester, are to be formally opened by Mr. J. T. Brownlie, the chairman of the National Executive Council, on Saturday.

Liquidations.—Auxiliary Electrical Co., Ltd.—Winding up voluntarily. Mr. F. R. Reeves, Liquidator, Salisbury House, London, E.C. Creditors' meeting February 4th.

Morris & Lister (London), Ltd.—Meeting March 8th at 36, King Street, Cheapside, E.C., to hear an account of the winding up from the Liquidator, Mr. H. S. Sugden.

Rotherham Electrical Engineering Co., Ltd.—Judge Benson, in the Sheffield Bankruptcy Court, made an order for a compulsory winding up of this company. Mr. E. J. Twigg, for the petitioning creditor, said judgment had been obtained against the company for £744, and the solicitors engaged in the matter agreed by the order.—*Sheffield Telegraph.*

For Sale.—Aberdare U.D.C. has for disposal one automatic reversible battery booster, direct coupled to shunt wound motor, 500/550 volts, 30 B.H.P. For particulars see our advertising pages to-day.

LIGHTING AND POWER NOTES.

Australia.—The Pyrmont electric swing bridge, at Sydney, after 15 years' operation, day and night, without a hitch, came to a stop recently, through the unthought of fracture of a worm on one of the operating shafts. Spares had been provided for every detail likely to break down, but not a spare worm. The broken worm was welded by the oxy-acetylene process, and the bridge was in operation again in 23 hours. In the 15 years of uninterrupted use the swing span has been opened over 97,000 times.—*Commonwealth Engineer.*

Armidale (N.S.W.) City Council has received two offers to install an electric lighting scheme in the town: one proposal is to generate power at an hydro-electric plant on the River Styx, and as the local gasworks is the property of the municipality, an alternative proposal is to purchase this concern and install an electric supply scheme, the two projects being controlled by the one authority.

Bacup.—The Electricity Committee has received notice from the Rawtenstall Corporation of an increase of ·006d. per unit in the price of electricity, owing to the increased cost of coal and wages.

Bradford.—Wages.—In regard to the recent confirmation by the Corporation of the War Wages Committee's recommendation of advances of war bonus from 12s. to 16s. per week for men, 6s. to 9s. for women, and 6s. to 8s. for youths, to date from October 1st last—despite the rejection of this offer by the employés, and a demand that the matter be submitted to arbitration—the War Wages Committee has now decided to arrange for a ballot of all employés concerned, putting the two questions whether they will accept the offer, or have the matter referred to arbitration. This course has been prompted by the gasworkers having stated their wish to accept the offer.

Burnley.—Wages Award.—The Committee on Production has issued its award on the recent arbitration between the Corporation and the Amalgamated Society of Engineers on the claim for the payment of a standard rate of 53s. per week, with overtime rates in addition, on behalf of the switchboard attendants, cablemen, wiremen, and motor superintendent in the Corporation's electricity department. The award is to the effect that the claim has not been established.

Continental.—France.—M. Dumas, Deputy of the French Chamber, has asked the French Minister of Public Works whether Article (3) of the Law of June 10th, 1917, concerning the maximum utilisation of hydro-electric energy, has been carried into effect; and if so, where and under what conditions. Reply: The maximum utilisation of electric power has been, and is still being, carried out in a permanent manner by the various services concerned. In fact, the Law in question has been applied in ten different Departments of France (named). As regards the conditions, these could not be published for various reasons. In 64 Departments the Law has not been put into effect, for insufficiency or absence of electric plant. In 12 other Departments the Law is in course of application, and efforts are still being made to give full effect to it.

Italy.—A new company has lately been formed in Rome with a capital of £12,000 and the title La Società delle Forzi Idrauliche Italiane, with the object of establishing plants for the utilisation of water power in the generation of electrical energy.

Glasgow.—Price Increase.—At a meeting of the Electricity Committee the engineer reported that the increase of wages, granted since November last, would entail on the electricity department a further additional expenditure during the current financial year of about £16,000, to meet which a further increase in the charges for electrical energy would be necessary, and the

Sub-Committee, after considering the report, agreed to recommend to the T.C. that as from and after the date of last survey until May 31st next, (1) that the charges for electrical energy per unit be increased by ·10d. on current rates; and (2) that the KW. rate be increased by 15 per cent.

High Wycombe.—Public Lighting Contract.—The dispute between the T.C. and the Electricity Co. with reference to the public lighting contract, owing to restricted lighting, has been settled, and the threatened litigation averted, and a new contract for seven years, from January 1st, 1916, has been agreed upon and signed.

Newport (Mon.). Plant Extensions.—The T.C. has agreed to the Electricity Committee's recommendations for extending the plant at the East power station, and application is to be made to the L.G.B. for sanction to borrow the necessary money and to the Ministry of Munitions for permission to proceed with the scheme. The extensions include a 3,000-KW. turbine set, with condensing plant, switchgear, &c., £31,118; 250-K.V.A. transformer and switchgear, £753; 120-H.P. motor for auxiliary plant for existing 3,000-KW. turbine set, £715; turbine-driven feed pump, £638; and extension of boiler house, £2,290; total, £35,514.

In a report on the subject, Mr. Nichols Moore, the borough electrical engineer, considered the alternative of linking-up with the South Wales Power Co., but found that if a 1,500-KW. supply only were obtainable the cost on the basis of a 22/30,000-volt transmission from the nearest available point of connection at Risca would be £30,000. Moreover, frequency changers would be required, or in the alternative rotary converters could be used to supply direct current, though the demand for the latter would be limited to 1,000 KW.; the latter arrangement would in practice preclude the possibility of a reciprocal supply, and would not furnish any direct stand-by to the existing three-phase plant.

As regards the National Electric Supply proposals, Mr. Nichols Moore points out that it may be many years before a concrete scheme materialises.

New Zealand.—A conference of local bodies of South Canterbury and Ashburton, at Timaru, recently passed a resolution calling upon the Government to fulfil its promises in regard to hydro-electric supply in that district before undertaking new schemes in the North Island.—*Auckland Weekly News.*

Normanton.—The U.D.C. is opposing the Yorkshire Electric Power Co.'s Bill on principle, though the town will not be materially affected.

Radcliffe.—For the first time since the electricity works were opened 14 years ago, there was a total failure of the supply on Thursday, last week. The bulk supply from Bury was interrupted, and for a period of seven minutes, before the staff got the local plant into operation, there was a total suspension of current in the district. The staff had to depend entirely upon the local plant for some three or four hours.

Stockton-on-Tees.—Price Increase.—The Corporation has increased the scale of charges for electric lighting and special rate power consumers by ½d. per unit, as from January 1st.

Tasmania.—Mr. J. H. Butters recently announced that a London company had inquired for 400 H.P., to be increased to 2,000 H.P. in the near future, for use in a works to manufacture a product for sale throughout the southern hemisphere. The Launceston City Council has agreed with the Government to meet the requirements from hydro-electric sources.

United States.—According to the *American Electrical Review*, over 4,000 communities are now quoting special rates for electric range cooking of 5 cents or less per unit. Electric ranges are rapidly coming into use, 100 central stations reporting over 14,000 connected up. The United States Fuel Administration has issued an order under which the "white ways" of all cities are to be discontinued on two evenings of each week. Exceptions are made in the case of Government lights, but no "white way" or cluster of lights will be permitted under any circumstances. It is strongly urged that hydro-electric companies co-operate in this, though the ruling does not cover hydro-electric power. An order of a similar kind has been issued in regard to electrically illuminated advertising signs, illumination on buildings, searchlights, &c. This order does not, apparently, apply to illuminated names on business houses, or to names of plays, &c., at theatres.

The American authorities have given assurances to the Canadian Government that approximately 100,000 electric H.P. imported from Canada will be used only for the manufacture of war products. The War Industries Board is developing plans for a redistribution of electric power supply in Buffalo and other cities. Industries of less importance are to be curtailed in their use of power.

Yorkshire Electric Power Co.'s Bill.—The Pudsey T.C. has given instructions for the protection of its interests with reference to the above Bill. The Bingley Council and the Skipton R.D.C. are taking steps to oppose the Bill.

TRAMWAY AND RAILWAY NOTES.

Australia.—The electrification of the Melbourne suburban lines has now reached a stage where the provision of a comparatively small amount of plant will allow electric trains to run on the Sandringham-Essendon line and a further addition to the equipment will place the Williamstown, St. Kilda, and Port Melbourne lines in commission. Much of the overhead work is complete; many sub-stations are built and awaiting plant, and the Jolimont car shed is complete and cars are being equipped there.—*Melbourne Age.*

Canada.—Montreal Terminal Electrification.—The electric zone of the Canadian Northern Railway extends about 10 miles, from passenger station in the city of Montreal, through the Mount Royal Tunnel 3⅓ miles long, to the village of Cartierville, where a freight yard is established. The electrification is on the 2,400-volt direct-current system, and has been in operation for a considerable period for hauling spoil from the station excavation. Power is purchased at 11,000 volts, three-phase, 60 cycles, and delivered to a sub-station at the Mount Royal portal of the tunnel, being there transformed by 1,500-KW. motor-generator sets, each consisting of an 11,000-volt synchronous motor driving two 750-KW. compound-wound commutating pole generators wound for 1,200 volts, insulated for 2,400 volts, and permanently connected in series. The shunt fields are separately excited. The pole face winding and the series and commutating field windings are all connected on the ground side, so that the armatures are the only parts subjected to the full potential of 2,400 volts.

Three motor-generator exciter sets are provided for exciting the fields of the synchronous motors and generators. Transformers supply small motors and lighting, and a battery is installed for emergency lighting and to operate the oil switchgear in case of a complete shut down. Catenary cross-span overhead construction is employed; the messenger is ½ in. seven-strand steel cable, with supports spaced 150 ft. apart, and the trolley wire is 4/0 B. & S. special bronze supported every 15 ft. by loop hangers.

Inside the tunnel the messenger cable is of phosphor bronze, supported every 9 ft. by iron yokes hung from the roof. Two bronze trolley wires are hung side by side by hangers at 15 ft. intervals from each messenger cable; the two trolley wires are employed to reduce wear and limit by additional weight the wave height of the wire when a trolley passes, this being essential on account of the small clearance. The rail bonds are of the ribbon type electrically welded to the rails.

Six 85-ton locomotives geared for a running speed of 45 M.P.H. are employed. Each locomotive has four axles, each twin-gear driven from a 315-H.P., 1,200-volt motor, two motors being permanently connected in series on the 2,400-volt trolley circuit. The motors are of the commutating pole type insulated for 2,400 volts. The locomotives are operated as two-speed machines, with ten points in series and nine points in series parallel. Current at 125 volts for operating the contactors and lighting, is supplied by a motor-generator set, the motor of which has two 1,200-volt windings and two 1,200-volt commutators in series. The air brake compressor is also driven by two 1,200-volt motors in series.

Multiple-unit trains are to be adopted for the local service, the motor coach equipment including four 125-H.P., 1,200-volt motors, connected two in series. The control is of the non-automatic type for multiple-unit operation; 600-volt current for the contactor circuits, air compressor, and lighting circuits is supplied by a motor-generator. An electric hot air system for car heating is employed, one 42-KW. heater being placed under each coach.

Colwick.—An inquiry has been held into an application promoted by the Nottingham Colwick Estate Co. for the construction of a light railway at Colwick, Notts., in connection with a scheme of industrial development in the district.

Hebden Bridge.—Negotiations are proceeding as between Halifax Corporation, Hebden Bridge Council, and Todmorden Corporation for the bridging of the gap of a mile, within the Hebden Bridge area, in what would otherwise be a continuous tramway and motor-'bus service connecting up Lancashire and Yorkshire. The scheme is for the extension of the Halifax tramways to Whiteley Arches, to be met there by the extended running of the Todmorden motor-buses. Halifax Corporation agrees that the venture would probably be a paying one, but lays down the conditions that all cost of road widenings should be borne by Hebden Bridge, that net profits or losses on the running of the new section should be shared equally between Halifax and Hebden Bridge, and that the latter should extend for a period of 21 years the lease for the Halifax tramways in its area.

Keighley.—The electric railless traction service between Keighley and Oakworth, which was recently suspended, has now been resumed.

London.—L.C.C.—The new regulations relating to the change points for transfer tickets to and from the tramway subway came into force on Monday. To meet the congestion of traffic at the Victoria tramway terminus in Vauxhall Bridge Road during the rush period, every evening and after 12 noon on Saturdays, passengers must leave the cars by the front platforms after the cars have passed the new cross-over which has just been completed, to facilitate a more speedy clearance of the cars leaving the terminus.

Pontypridd.—Electric Vehicles.—In a report, the engineer of the U.D.C. gives the result of working two 2-ton Edison refuse vehicles during the last six months of 1917. These vehicles cost £1,020 each; the tires are guaranteed for 10,000 miles, and 1d. per mile is allowed for renewals. The charges during the period, including interest, sinking fund, insurance, renewals, &c., were £410, and operating costs, £761; 4,730 tons were carried, making the cost per ton 3s. 2·9d., as against 4s. 6d. to 5s. per ton by horse haulage : 2·8 units were used per mile, the rate for energy being 1½d. per unit. The saving of 1s. 6d. per ton represents £351. A third vehicle has been added, and another is being obtained.

Stalybridge.—At the monthly meeting of the Joint Tramways and Electricity Board it was resolved that the precept for the deficit on the tramway undertaking be £5,000, to be levied in equal portions of £1,250 on each of the four Corporations. Alderman John Bradbury, chairman of the Finance Committee, said that two years ago they issued a precept for £7,000 to meet a deficit of £10,000, and the following year they levied a precept for £7,000, which met the liabilities of that year and paid up the £3,000 of the previous year. Last year they issued a precept for £5,000, and this year, if they could have been quite sure as to the course of next year, they might have been able to do with less than £5,000. But they were faced with the prospect of a greatly increased expenditure, and wages alone seemed likely to take £5,000 or £6,000 additional, and they thought it a prudent step to make the levy they were doing. The precept was approved.

West Ham.—In regard to an application by the Council to the B. of T. for sanction to borrow £3,500 for the purchase of 20 car bodies for the tramway undertaking, the Ministry of Munitions has written suggesting that the best means of relieving the situation would be by the transfer of cars from other less important lines. In the event of such arrangement, involving the purchase by the West Ham Corporation of the cars so transferred, the Corporation should have the necessary facilities to raise the loan for the purchase of such cars. No final decision has yet been arrived at.

Yorkshire (West Riding).—Batley and Staincliffe people are much upset by the suspension of the morning tramway service on the Thorncliffe Road route by the Yorkshire (Heavy Woollen District) Electric Tramways, Ltd. A protest against the suspension has been made by the Infirmary Committee of the Staincliffe Institution and endorsed by the B. of G., and it has asked the Batley T.C. to support it.

TELEGRAPH AND TELEPHONE NOTES.

China.—According to information received from Tien-Tsin, attempts made by German interests to install Telefunken wireless stations throughout China have been frustrated. The position of the Marconi Wireless Telegraph Co., under the agreement signed in 1914, has been definitely established by the British Legation at Pekin.—*T. and T. Age.*

France.—It is announced that the Compagnie des Cables Télégraphiques is participating in the formation of the Société de Radio-Télégraphie, which will have a share capital of £500,000, divided into 25,000 £20 shares. Of the total, the former company will subscribe 30 per cent., the Marconi group 40 per cent., and the balance will be taken by the Banque de Paris and the Banque Française. The new company will absorb two concerns which manufacture apparatus for wireless telegraphy, whilst the Marconi group will bring in a wireless station established at New York by the United States subsidiary. The Société Française Radio-Electrique states that it will not take any part in the new company, and that it is not disposed to be absorbed by anyone.

Italy.—The telegraphic rates for foreign countries will be raised by 40 per cent. from February 1st, in view of the high rates of exchange.

U.S.A.—Wireless communication has been established between Italy and the United States.

Peru.—A wireless station, designed to communicate with Bolivia, Chile, Argentina, Uruguay, Paraguay, and Brazil, was inaugurated at Cachendo (Peru) in December last.—*Review of the River Plate.*

United States.—The chain of high-power wireless stations, whose construction was authorised by Congress in 1912, was completed in December by the opening of the Cavite station, Philippine Islands. The stations comprising the chain are :—Arlington, Darien, San Diego, Pearl Harbour, and Cavite.

Through the organisation of the Pan-American Wireless Telegraph and Telephone Co., a new Delaware corporation, a chain of high-power stations will be erected which will connect the United States with Mexico, and Central and South America, for commercial wireless communication. Work will begin on the United States and Argentina stations immediately. The new corporation has acquired the right to use all patents and concessions of the American and English Marconi Companies, and the Poulsen-Petersen system.

The Marconi Wireless Telegraph Co. of America, through its large interest, which amounts to a control, in the Pan-American Wireless Telegraph and Telephone Co., has extended its zone of activities so that it now will be able to cover all America, whereas it has heretofore been confined to the United States and dependencies, all foreign stations having been under the control of foreign corporations.

Mr. Edward J. Nally has been elected president of the Pan-American Wireless Telegraph and Telephone Co., and the Honourable John W. Griggs, chairman of the Board.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

February 2nd. Waterworks department. Electrically-driven radial arm crane. See "Official Notices" January 4th.

Adelaide.—February 27th. P.M.G.'s Department. Telephone material. Schedules 479 and 483. See "Official Notices" January 18th.

Belfast.—February 7th. Telegraph ironwork, wire, batteries, electric lamps, carbons, &c., for the Midland Railway Co., Northern Counties Committee (Ireland). Mr. Ellis, Stores Superintendent, York Road Station.

Manchester.—February 12th. Tramways Department. General stores, including electric lamps, insulating material overhead equipment, &c. See "Official Notices" to-day.

Newport (Mon.).—February 18th. Electricity Department. One 3,000-kw. turbo-alternator and surface condensing plant. See "Official Notices" to-day.

CLOSED.

Government Contracts.—The Alpha Manufacturing Co., of Balham, S.W., have lately received a number of lighting installation contracts, including lighting for the Science Museum, the Western Galleries of the Kensington Museum, and plant or lighting, or both, for a number of Government factories.

Leeds.—Messrs. R. H. Longbotham & Co., Ltd., Wakefield, have acquired by tender generating plant from the Leeds Corporation Electricity Works, which is being replaced by larger plant.

West Ham.—The T.C. has approved arrangements made by the electrical engineer, with Messrs. Brunner, Mond and Co., for a five years' contract for alkali for the water softener at the generating station. The engineer is to purchase unslaked lime on the best terms possible.

FORTHCOMING EVENTS.

London Association of Foremen Engineers.—Saturday, February 2nd. At 7 p.m. At Cannon Street, Hotel, E.C. Discussion on "Scheme for the Encouragement of the Better Training of Lads in Engineering Workshops."

Chief Technical Assistants' Association.—Saturday, February 2nd. At 3 p.m. At the Tavistock Hotel, Covent Garden. Ordinary meeting.

Royal Society of Arts.—Monday, February 4th. At 4.30 p.m. At John Street, Adelphi. Cantor Lecture, "High Temperature Processes and Products," by Mr. C. R. Darling. (Lecture III.)

Tuesday, February 5th. At 4.30 p.m. Paper on "The Industrial Resources of South Africa," by Mr. C. du P. Chiappini, Trades Commissioner for the Union of South Africa.

Wednesday, February 6th. At 4.30 p.m. Paper on "The Development of the Mineral Resources of the Empire," by Prof. W. Frecheville.

Roentgen Society.—Tuesday, February 5th. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. 2. Papers on "A Simple Means of Obtaining Static Currents from an Induction Coil," by Mr. G. B. Batten, and "A Mobile Snook Apparatus," by Mr. E. E. Burnside.

Institution of Civil Engineers.—Tuesday, February 5th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "The West Quay of Madras Harbour," by the Hon. Sir F. J. E. Spring, and Mr. H. H. G. Mitchell.

Institution of Electrical Engineers.—Thursday, February 7th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. 1. Ninth Kelvin Lecture, "Kelvin as a Teacher," by Prof. M. Maclean.

(**Dublin Local Section.**)—Friday, February 8th. At 8 p.m. At the Royal College of Science, Upper Merrion Street. Ordinary meeting.

(**Students' Section**).—Friday, February 8th. At 7 p.m. At Faraday House, Southampton Row, W.C. Paper on "Magnetos," by Mr. R. W. Corkling.

Midland Electric Power Supply Engineers' Association.—Thursday, February 7th. At 7.30 p.m. At the White Horse Hotel, Congreve Street, Birmingham. Annual general meeting.

Greenock Electrical Society.—Thursday, February 7th. At 7.45 p.m. At 22, West Stuart Street. Paper on "Armature Winding," by Mr. W. R. Scott.

Royal Institution of Great Britain.—Friday, February 8th. At 5.30 p.m. Lecture on "Science and Ethics," by Prof. E. H. Griffiths, F.R.S.

North of England Institute of Mining and Electrical Engineers.—Saturday, February 9th. At 2 p.m. At Neville Hall, Newcastle-on-Tyne. Ordinary meeting.

NOTES.

The Red Light!—The Leeds Nineteen Club has adopted a system of electric lamps in order to set a limit to the duration of speeches. On the chairman's table are three electric bulbs, coloured white, green and red. A time limit upon speeches having been decided upon, the chairman, with a stop-watch on the table before him, puts on the white light when a speaker begins. When the limit is getting near, the green light gives warning, and the end of the time is quietly indicated to garrulous speakers by the red light.

Employment in the Iron and Steel Trades.—The Minister of Labour has appointed the Iron and Steel and Kindred Trades Central Advisory Committee (Employers) to advise and assist the Ministry of Labour on questions arising in the administration of the Employment Exchanges which affect employers in that industry.

The Metric System.—As "signs of the times," we note with interest the contents of two price lists for terminal and junction boxes, recently issued by Messrs. W. T. Henley's. One of these is printed wholly in French: naturally, therefore, the dimensions of the conductors and of the boxes are given in millimetres, the weights in kilograms, and the prices in francs, though the sizes of the fixing bolts remain in inch measure. But the other is in English, and in this case also all the dimensions of the boxes are again *given in millimetres only*. Comment is unnecessary.

Electric Lamp Stealing.—At Southport, last week, four boys were charged with stealing 22 electric lamps from a station on the L. and Y. Railway. The lamps were valued at £2 2s. It was stated that the bulbs had been taken from the fittings at the station, and none of them had been recovered. To get at them the boys would have to climb eight or nine feet. Two of the lads said they took the lamps in order to burst them and "make an explosion." A further charge against three of the lads was of stealing six electric lamps from the Southport band enclosure, and it was stated that 81 bulbs had been missed since October. The lads were ordered to pay the cost of the lamps and their parents were bound over.

The 12½ per Cent. Bonus.—According to the *Times* it is officially announced that a large number of cases arising out of the Orders under which a bonus to munition workers has been given have been referred by the Ministry of Labour to the Committee on Production or to the Special Arbitration Tribunal, and decisions have been given in the five following cases.—

Platers and Riveters, Yarrow & Co., Ltd.—Entitled to the 12½ per cent. bonus.

Poilermakers, Gun-Mounting Department, W. Beardmore & Co., Ltd., Dalmuir.—Not entitled to the 12½ per cent. bonus, but will receive a bonus of 7½ per cent. on earnings.

Water Testers, W. Beardmore & Co., Ltd., Dalmuir.—Not entitled to the 12½ per cent. bonus, but will receive a bonus of 7½ per cent. on earnings.

Engineers, Moulders, and Electrical Fitters.—Mond Nickel Co., Ltd., Clydach.—Entitled to receive the 12½ per cent. bonus.

Engineers and Ironmoulders, Baldwins, Ltd., Panteg.—Entitled to receive the 12½ per cent. bonus.

In a circular forwarded by Mr. H. Faraday Proctor to the members of the I.M.E.A., several points in connection with the award are elucidated, in reply to queries addressed to him. The Bristol Electrical Committee has decided to give the 12½ per cent. award to *all* employés of the department (both sexes) who are in receipt of a net wage or salary (exclusive of any bonus) not exceeding £250 per annum. Officials with higher salaries are to be dealt with according to any recommendations that may be made by the Joint Executive of the I.M.E.A. and other Associations. The 12½ per cent. addition is applied to the net wage or salary and also to the bonus already given.

Subject to any awards or arrangements made locally, no bonus except the 12½ per cent. is compulsory. It is not obligatory to raise existing bonuses to £1 per week. The expression "plain time working employé" does not include men paid an upstanding wage. "Technical staff" does not include general clerical staff, although it may include some of them. The 12½ per cent. is to be reckoned on the ordinary pay, plus overtime, plus war bonus.

Coal Conservation and the National Electricity Scheme.—The opening address of a series of lectures on reconstruction problems, to be delivered in Dewsbury, was given by Mr. W. B. Woodhouse, chief engineer and manager of the Yorkshire Electric Power Co., who dealt with the subject of "Coal Conservation and the National Electricity Scheme." Mr. Woodhouse pointed out the necessity of increasing the productivity of labour, thereby requiring the use of more power, but, at the same time, not reducing the quantity of fuel available for export.

In the U.S. the production of coal per man was 660 tons, as against 250 tons in Great Britain; in the textile clothing trade, the annual value of the production per person employed in the U.S. was £484, as against £158 here; the primary cause for the difference was that American industry used approximately three times as much power as was used here in corresponding trades. The solution of the problem was the more economical use of fuel and the cheapening of power supply, the one being a consequence of the other. Mr. Woodhouse went on to refer to the Coal Conservation Sub-Committee's recommendations, and to trace the development of public electricity supply in this country, pointing out the difficulties which had prevented the power companies from attaining success.

The cost of producing power depended on the size of the generating plant and the regularity of its use.

The capital expenditure on a station of 100,000 KW. would be no more than that on 50 stations of 1,000 KW. each: therefore, a clear saving of half the cost of small stations could be effected, and the same total output be given.

The larger station should not use more than 1½ lb. of coal per unit, while in small stations it varied from three to six times as much.

The annual output of the Yorkshire coalfield was some 40 million tons, of which approximately 12 million tons were used in the West Riding for power purposes. Existing undertakings were supplying not more than one-twentieth of the power, and if all the power were produced electrically, a saving of at least 50 per cent. could be made.

If the Yorkshire collieries were connected on the power supply systems, the saving in their own coal consumption would be more than enough to generate all the power required by the Yorkshire textile mills.

There were 27 independent authorities supplying electricity in the West Riding, mostly on a small scale from unsuitable sites.

Large power stations might have to be built at some distance from the centre of the area, with a view to water facilities, but there were no technical difficulties in the transmission of power.

As regards the handling of the national scheme, small company and municipal concerns should be taken over, and, with goodwill on both sides, there should not be any real obstacle to a joint working arrangement between the large power companies and large municipalities.

Personally, he felt that progress would be most rapid if the Reconstruction Committee's preference for company management were accepted; if, however, the municipalities desired to continue with the business, some means of association between them and the companies would be necessary by which they would share in the provision of capital and in the profit resulting from the work done.

Glasgow Tramcar Accident.—At an inquiry under the Fatal Accidents (Scotland) Act, into the circumstances attending the deaths of three men who lost their lives in the accident to a Glasgow T.C. tramcar recently, the jury added the following rider to a formal verdict:—"We are of opinion that the accident was caused by the tramcar taking the curve at excessive speed, and through the brakes not being applied soon enough. Owing to insufficient light the driver failed to see the curve in time to prevent an accident. We recommend that the stopping-place at this, and all similar curves, be placed before the curve, instead of in or round the curve."

Fatality.—A verdict of "Accidental death" was returned at Wigan, last week, on Elias Ashcroft (39), of Appley Bridge, employed as an electrician at Messrs. Thomas Witter & Co.'s linoleum works, Appley Bridge, who died as the result of falling into a vat of boiling linseed oil at the works.

Industrial Reconstruction Council.—The Lord Mayor will preside at the inaugural meeting of the Council on Friday, February 15th, at 3 p.m., at the Guildhall, London. Dr. Addison, Mr. G. H. Roberts, Lord Burnham, Mr. J. H. Whitley, and other speakers representative of industrial interests will deal with the practical problems of industrial reconstruction. This is the first of a series of important meetings which the Council is arranging with the object of focusing public opinion upon the industrial problems that will arise at the end of the war. Applications for tickets should be made to the Secretary, the Industrial Reconstruction Council, 8, Bouverie Street, E.C. 4.

Inland Transport.—The *Times* understands that the question of the control of all forms of inland transport—except the railways, which will be controlled, as heretofore, by the Railway Executive—is engaging the immediate attention of the Government. Important develpments may be expected shortly.

Meters on a Changed Frequeney.—Replying further to "Query" on this subject, "T" (Urmston) states that the figures given in his former letter were the actual figures obtained on meters calibrated for 50 periods and tested at 40 periods on inductive and non-inductive loads. As the loads are all non-inductive, and in view of the small errors produced, there is no need for "Query" to retest his meters. The figures quoted cover four out of the five types of meters which are in use.

An Enlightened Trade Union.—Hull Education Committee draws attention to a somewhat remarkable development in connection with the training of apprentices. The boiler makers of Messrs. Earles' Shipbuilding Co. met together and impressed upon the apprentices the necessity of joining technical classes, and undertook to advance to them the fees and cost of books and materials, to be repaid by instalments. As a result of this, one class of 35 boiler makers' apprentices was entered at Craven Street. This is an almost unique case in engineering, of an organisation of workmen distinctly bringing pressure to bear on the apprentices in this way. Further, the Boiler Makers' Society has also been bringing strong pressure to bear on elder apprentices, to join a special class in boiler makers' work that has been opened at the Technical College.

The Electrification of Railways.—Discussing a paper by Mr. Kirkland, which was read before the South African Institute of Electrical Engineers, Mr. F. W. Mills, chief electrical engineer of the South African Railways, stated that the section best adapted for electrification was that between Ladysmith and Durban, on which a through goods train could not take more than 650 tons. If they increased the load to 1,000 tons and doubled the speed by electrification, which could easily be done, the duplication of the single line could be deferred. Coal was cheap, and the displaced steam locomotives could be used at once on some other part of their large railway system. An exhibition of views of the Chicago, Milwaukee, and St. Paul Railway which Mr. Kirkland had given to the senior railway officers and others had been of educational service, and gave them clear ideas of what electrification meant, and would be the means of securing a far more sympathetic treatment of the subject than could otherwise have been obtained. A representative of Messrs. Merz & Maclellan was investigating the subject for the Administration.

Long-lived Electric Vehicles.—Five electric trucks purchased in 1899 by a New York firm of silversmiths are in use to-day. The cars were manufactured by the Riker Co.: other one and two-ton trucks were added a year or so after the original ones. While these are probably the oldest commercial electrics still in service, says an American contemporary, others have been in use for a long time, and 10-year-old installations are not uncommon.

Engineer Sentenced.—At the Old Bailey, on Wednesday, Alfred Horswill Gibbings, aged 51, an engineer who had been engaged in the Machine Tool Department of the Ministry of Munitions since November, 1916, was sentenced to four months' imprisonment in the second division for attempting unlawfully to communicate information obtained, owing to his official position, to a correspondent in Switzerland. It appears from the Press reports that prisoner, who was in receipt of £400 a year, which was advanced to £500, complained that he could not live on that salary, and that he proposed to form a syndicate of Swiss manufacturers to trade here in machine tools. Correspondence was intercepted by the Censor. Defendant said that at the time he did not know he was doing wrong.

The Féry Primary Cell.—At the meeting of the Société Internationale des Electriciens on January 3rd, M. Ch. Féry gave further particulars regarding his cell, which has been adopted successfully by several railway companies. He showed that the depolarisation of the cells is not proportional to the geometrical surface of the carbons, but to their active surface, which may be much greater, and that their working depends on their purity and that of the sal-ammoniac solution. The output curve of these cells at constant current is practically the same as the discharge curve of an accumulator; a Féry cell gave 95 ampere-hours per gramme of sal-ammoniac, and the output of the zinc electrode was 95 per cent., a value never previously attained. The cell was described in our issues of August 10th, and December 7th, 1917.

An Australian Industrial Agreement.—We are indebted to Mr. H. R. Harper, city electrical engineer, Melbourne, for particulars of an agreement which was recently entered into between the City Council of Melbourne and the Federated Engine Drivers' and Firemen's Association of Australasia. A Conference had been called by the President of the Commonwealth Court of Conciliation and Arbitration between the parties, in June, 1916, but agreement was not attained, and the questions at issue were referred to the Court. But in the meantime, the parties conferred in March, 1917, and agreed to settle all the questions in dispute, with a view to securing industrial peace. It was resolved that the terms should hold good for three years, no matter whether the conditions of life, cost of living, or other factors varied or not during that period, and that if either of the parties, or any member of the Association, made application to the Court or any Wages Board and secured an award varying the code, the party suffering damage by such award should be entitled to repayment therefor by the other party.

The code of regulations sets forth that eight hours shall constitute a day's work, and that overtime shall be paid for at the rate of time and a half on week days and double time on Sundays, except when worked by arrangement between the employés or for the purpose of changing shifts, &c. Six consecutive working days' annual leave are to be granted, as well as nine consecutive days in lieu of the public holidays, making a total of 15 days with pay, after 12 months' service.

Sunday duty is to be paid for at time and a half. The scale of wages is to be as follows:—

	s.	d.
Engine drivers in the power house .... (per day)	13	6
Assistant engine drivers (with first-class certificates)	12	6
Leading firemen ...	13	0
Firemen ...	11	6
Trimmers ...	10	6
Ash men ...	10	0
Conveyor attendant ...	11	0
Switchboard attendant ...	13	0
Sub-station attendant ...	12	6
Dynamo attendant ...	10	6

When the capacity of the plant under load does not exceed 10,000 KW., at least one driver and one attendant shall be employed, and for every additional 5,000 KW. an additional assistant. Where mixed duties are performed in any one day, the wages are to be based for that day on the highest scale involved. Men cleaning boilers or economisers are to receive 6d. an hour extra, and men cleaning straining pits or crank chambers 1s. 6d. an hour extra. One fireman is to be employed for every six boilers under steam, with a margin of one boiler per man; not exceeding four boilers, one leading and one ordinary fireman; ditto six boilers, + one trimmer; ditto nine boilers, + one fireman; ditto 14 boilers, + one trimmer.

This agreement was signed by the parties on September 18th, 1917, and was certified by the Court on October 18th, 1917. It will be seen that it constitutes a sincere and praiseworthy attempt to ensure industrial peace for at least three years, and we trust that it will be as successful as it deserves to be.

The Grouping of Cells in a Battery.—The publication of a letter on this subject in our last issue, under the heading of "Prof. Walker's Battery Rule," has called forth a protest from Prof. Miles Walker, who disclaims the invention of any rule in connection with batteries; we regret, therefore, that we have been the means of unjustly attributing to him the enunciation of a rule which is alleged to be inaccurate.

From a perusal of the correspondence which has passed between the Principal of the Manchester School of Technology and Mr. W. F. Dunton, we gather that the latter initiated the discussion in September last, in pursuance of a pet idea which he has nursed for many years. In our issue of November 9th, 1906, page 746, we reviewed his book on the "Grouping of Electric Cells," and pointed out that the subject was of no practical importance; we still hold this view, and approve of the Manchester decision to defer the discussion to the conclusion of the war—or, for that matter, of the century.

Travelling Tramcars for New Municipal Kitchens.—The services of Mr. G. W. Holford, the general manager of the Salford Corporation tramways, have been requisitioned on behalf of the Ministry of Food. The Mayor of Salford on Monday received a letter from Alderman Spencer, chairman of the Halifax Corporation tramways (who commenced his duties last Monday as director of the Central Kitchens Division), asking that Mr. Holford should be released in order to be assistant director of the scheme, a part of which is to provide travelling kitchens to run on the existing tramway lines in different areas, and thus get a speedy and better distribution.

The request will be considered by the Salford Tramway Committee at an early date.

Conditions in Mexico.—Owing to the chaotic conditions existing in the mining section of Mexico, especially in the States of Guanajuato, Jalisco, Michoachan and San Luis Potosi, American miners are fleeing from that district to escape Mexican bandits operating there. The large hydro-electric plant of the Guanajuato Power and Light Co., at El Duro, Michoachan, has been partly destroyed and is out of commission, and much transmission cable has been carried off, resulting in the shut-down of many mills, smelters, irrigation plants, industrial establishments, &c., which were dependent upon the power plant for service. The company is composed of Americans, with stock owned by men of Colorado Springs, Colo. It will take several months to repair the damage sufficiently to resume operations.—*Electrical Review*, U.S.A., December 22nd.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending February 9th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Second Lieut. E. A. Uilmann.

Next for Duty.—Lieut. C. E. Campbell.

Monday, February 4th.—Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 5th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, February 6th.—No. 1 Company, Entrenching, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 7th.—No. 2 Company, Entrenching, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, February 8th.—Musketry, 5.30—8.

Saturday, February 9th.—Knotting, &c., for the whole corps, 2.45—4.45. Musketry, 2.45—4.45.

All drills will take place at Headquarters, unless otherwise stated.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

WARWICKSHIRE VOLUNTEER ENGINEERS.—We have received a neat folder issued by this Corps (H.Q. at Drill Hall, Thorp Street, Birmingham), giving in convenient form the Morse alphabet official prefixes, code time, and the special signals in use in the Service.

Electric Time Signals.—A new type of time signal has recently been installed at the Hector Observatory, Wellington, N.Z. Three electric lamps are mounted in a vertical row on the observatory flagstaff, 6 ft. apart—the lowest green, the middle red, and the highest white. The lights are switched on 15 minutes, 10 minutes, and 5 minutes respectively before the hour of the signal, at which hour they are all extinguished simultaneously. The signals are given at 20 hours, 21 hours, and 22 hours Greenwich mean time.—*Electrical Trades Journal.*

Customers and Population.—The Society for Electrical Development, of New York, has recently issued a compilation showing the proportion of residence customers served to population served by the various central stations in the U.S.A. during 1917. The Society considers that there is a great demand for an accurate, complete electrical census—not guess work—and it is one of the purposes of the Society to get this information for the use of its members. It is considered that such information will be valuable to manufacturers and contractors as an indication of possible development work.

Portsmouth Dockyard School.—At the recent annual prize distribution, presided over by the Admiral Superintendent, supported by the staff and other dock-yard officers, the headmaster presented his annual report. A year of steady progress and inter-school successes has been made noteworthy by the following special achievements of the Fourth-Year Students:—G. Bryant, A. G. Stickly, and H. T. Johnson appointed to cadetships in Naval Construction; Mr. Scott, first place in competition for Army Cadetships to Woolwich, &c.; R. Baillie, awarded Whitworth Scholarship; nine other Fourth-Year Students awarded Whitworth Exhibitions. There are now over 400 apprentices under instruction at the school, and among other organisations the apprentices have a flourishing Cadet Corps, which has the reputation of being "the best Cadet Corps in Hampshire."

Remuneration of Professional Men in Australia.—The Australian *Chemical Engineer and Mining Review* states that the Queensland Industrial Arbitration Court has given judgment in a case in which the employés of the Railway Department petitioned for a wages award. The powers of the Court have been limited by regulation to the fixing of salaries where the rate does not exceed £300 per annum. The following instances will serve to illustrate the scale of the new award:—Power-house engineer, £290; assistant power-house engineer, £260; assistant surveyors and assistant construction engineers (exclusive of allowance), £275; first-grade draughtsmen, £250; draughtsmen, 21 years of age, £160. An important clause in the award provides that any assistant engineer or any person having the degree of Bachelor of Engineering or the diploma of engineering issued by the University of Queensland shall be paid a salary of not less than £210 per annum.

Fuel Economy in Germany.—The twenty-fifth general meeting of the German Union of Electricity Supply Undertakings was recently held in Berlin, when among the papers read was one by Herr Kreyssing on "Improved Gasification of Coal and By-product Recovery, and its Importance for Electricity Supply Undertakings."

Northampton Polytechnic Institute.—On January 19th the annual prize distribution took place at the Institute, and the Principal, Dr. R. M. Walmsley, in his report gave an account of the activities of the staff and students during the session 1916-17, which have been largely directed into channels of national importance. During the preceding session only a first-year course had been held in the Engineering Day College, but at the beginning of the new session it was found possible to carry on with both first and second year work.

The Technical Optics Department was not able to do this, even young students being called away for commercial work, but the Department was kept very busy, training women in grinding lenses and prisms, throughout the year, with highly successful results.

In some of the evening classes the number of enrolments had begun to increase again, but the demand for trained signallers depleted the telegraph and telephone classes. In the current session the total enrolments have actually increased in number. The influence of the war in taking away the senior students is reflected in the number of hours worked per head, which was 48 as compared with 70·6 in peace time.

The training of disabled soldiers and sailors has continued, and up to the end of July, 1917, eleven complete courses for training men as sub-station attendants had been given: the whole of the men trained were placed out. The records show that 53 members of the staff, 542 members and students, and 802 students have joined the Colours, and there are 104 V.A.D.'s serving in military hospitals. The Roll of Honour contains the names of 80 men who have given their lives and 172 who have been wounded. A considerable amount of experimental work has been done for the Government in the Institute.

City and Guilds of London Institute.—The report of the work of the Department of Technology for 1916-17 states that the calling-up of lads on attaining the age of 18 years had a serious effect on the attendances at classes and on the number of candidates for examinations, and the high wages paid to youths further interfered with their attendances. While the numbers enrolled showed decreases in most subjects, in mechanical and electrical engineering they were well maintained, and in several chemical subjects and in iron and steel manufacture increases were recorded.

In Electrical Installation Work the examinations were held for the first time on the revised syllabus: it is remarked that the practical tests indicated that the tools which well-equipped schools should have possessed for working in electric light tubing were often wanting, and, on the whole, the practical work was unsatisfactory. The need for adequate equipment of the electrical workshop, as well as the electrical laboratory, is impressed on the education authorities.

This subject was taught at 38 centres (a decrease of 10); there were 704 students in attendance, and 121 candidates, of whom 67 passed. In Electrical Engineering, taught at 101 centres (a decrease of 7), there were 3,529 students and 1,064 candidates, of whom 663 passed (against 367 in 1916).

Institution and Lecture Notes.—Allen West Engineering Society.—At the fortnightly meeting of the above Society in Brighton, on January 22nd, a lecture was given on "Auxiliary Machinery of Rolling Mills," by Mr. James Calderwood, of Messrs. Wellman Seaver Rolling Mills, Ltd. The lecturer dealt with the design and construction of such auxiliaries as screwdown gear, manipulators, live roll, &c., and traced the course of an ingot, through the blooming rolls and finishing rolls to the hot saws. The objects of this Society are primarily the instruction of the staff and foremen of Messrs. Allen West & Co., Ltd., but in view of the general interest of such a lecture, a number of Messrs. Allen West's customers and friends residing within easy reach of Brighton, were invited. This experiment proved very successful, and appreciation was expressed by the visitors.

Other papers already read this session before the Society are:—"Theory of Motor Starting," by Mr. R. P. Bossom; "Motor Starters and Drum Controllers," by Mr. A. Harrison; "Lifting Magnets," by Mr. F. N. Pickett; "Liquid Controllers," by Mr. H. Brooke; and "Contactor Equipments," by Mr. L. Wise.

Papers by prominent engineers are to be read before the Society on such subjects as Steel Works Charging Machines, Overhead Cranes and Printing Machines, and Messrs. Allen West will be pleased to send invitations to any of their friends if they will write the Hon. Secretary of the Society, Mr. F. N. Pickett, at Brighton.

Association of Engineering and Shipbuilding Draughtsmen.—A meeting of the members of the Merseyside Branch of the Association was held on Saturday last, at the Angel Hotel, Liverpool. Mr. J. D. Murray, president of the branch, occupied the chair, and gave an interesting account of the Delegates' Conference recently held in Manchester. Mr. D. Spencer, vice-president, referred to the gratifying increase in the membership, and the excellent work done by the Merseyside Branch.

A short address was given by Mr. J. E. Jolley, secretary of the Manchester Branch, who spoke of the magnificent progress made by the Association in its efforts to advance the interests of the profession. He pleaded for a level-headed, but vigorous policy, and pointed out the success of the Association depended entirely upon each man doing his utmost for the cause at every available opportunity. An excellent musical programme was given under the direction of Mr. Percy Dalziel. It was announced that a series of lectures would be given during the remaining winter months, under the auspices of the Merseyside Branch, and the first would be by Mr. G. G. Dobie, B.Sc., at the Ranelagh Hotel, Birkenhead, on the 31st inst.

Manchester Association of Engineers.—Last Saturday, Mr. L. Rothera, B.Sc., read a paper on "Rolling Mills and the Electric Drive."

The Strikes in Germany.—In connection with the reported strikes in Germany, a "Wireless Press" dispatch, dated Amsterdam, January 29th, says:—"The Allgemeine Elektricität Gesellschaft in Berlin has closed its doors."

A Reuter dispatch says:—"The big strike has not materialised. In a few factories only a section of the workmen did not come to work, but a complete stoppage of work does not appear to have occurred anywhere. Amongst the works where a partial stoppage is reported are those of the Ludwig Loewe, the A.E.G. (General Electric Co.), the Borsig, and the Daimler."

The *Times* correspondent at Amsterdam, in a dispatch dated January 30th, says:—"The great majority of the workers are working at the Berlin works of the A.E.G. At the Herungsdorf (?) and Johannisthal works the situation is more threatening, as the majority of the workers there have 'downed tools.' About 8,000 workers have struck at the Daimler works and the factories of the firms of Beck & Co. and Fritz Werner at Lichterfelde."

A Central News correspondent at Amsterdam says:—"Amongst the latest accessions to the ranks of the strikers are 13,000 workers at the factories of the A.E.G. at Hennigsdorf (?) (one report says Honnigsdorf) and Johannisthal, 5,500 at the Schwartzkopf works, 7,000 at the Borsig works, 9,000 at the Auer works, 9,500 at the Goertz factories, and 4,000 at the Westphalian mines."

Appointments Vacant.—Mains foreman for the Burgh of Wishaw electricity works; two assistant overhead linesmen for the Rochdale Corporation tramways; shift engineer (58s. 3d.) for the Stockton-on-Tees Corporation Electricity Works; shift engineer (63s.) for the Eccles Borough Electricity Department; head of the Electrical Engineering Department of the Loughborough Technical Institute (£300). See our advertisement pages to-day.

Inquiry.—The makers of "Pulleystone" are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At a meeting of the Electric Supply Committee of the Birmingham Corporation, Mr. Frank Forrest was appointed chief assistant electrical engineer in the electric supply department. There was 95 applicants for the post. Mr. Forrest has held the position of sub-stations engineer in the City of Birmingham electric supply department for the past 12 years.

The Dover Electricity Committee has recommended that the salary of the electrical engineer, Mr. L. Woodman, be increased from £425 to £500 a year.

Barnsley T.C. has increased the salaries of Messrs. A. C. Dennis and K. Beeson, shift engineers at the electricity works, from £2 10s. to £3 per week, this to include war bonus.

The Ilford U.D.C. Staff Administration Committee recommends that the salary of Mr. A. H. Shaw, the electrical engineer and manager, be increased from £500 to £600, by two annual increments of £50.

Walthamstow U.D.C. Light Railways Committee has recommended that Mr. T. Evans, of Walthamstow, be appointed to the position of traffic superintendent at £150 per annum, without war bonus, with a maximum of £200 per annum.

General.—A social and musical evening was held on January 24th at the Douglas Hotel, Manchester, by the staff of the British Westinghouse Co.'s supply department. During the evening Mr. Ellam, assistant manager of the department, announced that the main purpose of the gathering was to show their appreciation of Mr. Gibson, their manager, who had so ably organised and developed the supply business that it was now recognised as one of the most prosperous departments of the company, and after being their chief for 11 years, they thought it high time that they should show their appreciation in some tangible form. Mr. Ellam, tracing the inception of the department up to its present satisfactory position, pointed out that this success was mainly due to the able way in which Mr. Gibson had managed the affairs of the department, and referred to the cordial relationship which had always existed between Mr. Gibson and his staff. On behalf of the staff, he asked Mr. Gibson to accept a silver tea and coffee service suitably inscribed, and hoped he would long be spared to continue as their chief. In reply, Mr. Gibson said that the success referred to was, in his opinion, due to the co-operation of the staff themselves. The spirit of hearty co-operation had enabled them to clear away the difficulties that had arisen since the war, with the result that 1917 had been a record year for the department.

The wedding took place at Blackpool, last week, of Mr. G. A. JORDAN, manager of the British Electric Detonator Co., St. Helens, and Miss Florence Gertrude Whitehead, of North Shore.

We have received from Miss S. Chance a copy of a 36-page pamphlet, giving personal and touching reminiscences of her father, the late Mr. A. M. CHANCE, of Birmingham, to whose death we referred several months ago. The references to his humane and religious devotion to the interests of his employés and his general contribution to the public good are of more than ordinary interest just now, when it is so desirable to bring master and man closer together. Copies of the pamphlet are obtainable by post (7d.) from Messrs. Cornish Bros., New Street, Birmingham, or from Miss Chance, at 11, Victoria Park, Weston-super-Mare.

Sir HENRY NORMAN, M.P., has been appointed to be an additional member of the Air Council.

Major H. W. DEVEY, of the Metropolitan Railway electrical staff, is at present employed as second-in-charge of large military work in this country. This officer was called up on August 4th, 1914, and served at Suvla Bay until the evacuation, when he was mentioned in dispatches. He afterwards served on the Western Frontier of Egypt, where he acted as Commanding Royal Engineers at Solloun.

Mr. L. FRAYNE BOYES, for some time chief outside representative for Scotland for the General Electric Co., Ltd., and well known in Clyde shipbuilding circles, subsequently representing the British General Electric Co., Ltd., of Australasia in Adelaide, South Australia, is now Investigator and Assistant to Advisers, Priority Permits Branch, New Zealand Munitions Department, Wellington.

Mr. W. A. SCOTT, J.P., F.C.A., has accepted a seat on the board of the Ascot District Gas & Electricity Co., to fill a vacancy occasioned by the resignation of Dr. H. J. Strong, J.P., of Worthing. Mr. Scott has been secretary of the company since 1898. Mr. H. T. Manwaring has been appointed his successor in the secretaryship.

Roll of Honour.—Major H. RICHARDSON, general manager of the Dundee Corporation electricity supply department, has been awarded the Military Cross. Major Richardson has been on active service in France since June, 1915, and, besides receiving the above decoration, has been twice mentioned in dispatches. He went out to France originally as Officer Commanding the Local Company of the Royal Engineers, but was promoted in September of last year to a much more responsible position there.

Two employés of Stafford Corporation gas and electricity department, Corporal J. HOLMES, R.E., and Private W. ROWLEY, R.A.M.C., have distinguished themselves by brave conduct on the battlefield. The former has been awarded the Military Medal, and the latter recommended for it. At a concert, attended by the Mayor and Corporation, a gold watch from the Committee, and a gold chain subscribed by employés, were handed to Holmes. It was stated that to every employé of the department who went on active service, a wristlet watch would be presented.

Lance-Sergeant R. G. CASTON, Loyal North Lancs., killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Sergeant A. RICHARDS, Manchester Regiment, killed in action, was formerly employed by Messrs. Charles Macintosh and Co., Ltd., Manchester.

Trooper R. E. BARNES, Household Battalion (Life Guards), who was electrician at St. George's Theatre, Canterbury, has been killed in action.

Sergeant C. ATKINSON, R.E., who has died in German East Africa from malaria fever, was a wireless operator. He was on the telegraphic staff of the Midland Railway Co., at Derby.

Armourer L. J. F. BENNETT, R.N., of Frome, who has died in hospital at Plymouth from pneumonia, was an electrical engineer.

Corporal V. VIDLER, R.E., formerly on the staff of the Hastings Tramway Co., has been awarded the Military Medal for gallant work in Italy.

Second-Lieutenant C. W. CASWELL, Middlesex Regiment, who has been awarded the Military Cross for good work in France, was with Messrs. Barnett & Sons, electricians, of Kettering.

The death in action is reported of Private G. W. WRIGHT, Northumberland Fusiliers, aged 19, who was employed at Blackburn electricity works.

Second-Lieutenant J. W. DUGDALE, Labour Corps, who has died of wounds, was for a period of two or three years the manager of the Oldham Corporation tramways. He was gazetted to the Labour Corps some months ago.

Many of our readers will desire to join with us in expressing sympathy with Mr. and Mrs. J. Snow Huddleston, of Blackheath, on the death of their eldest son, Probt. Flight Officer L. G. HUDDLESTON, R.N., who was killed on January 22nd, aged 18½ years, whilst flying in Lincolnshire.

Obituary.—SIR J. WOLFE BARRY. The following tribute to the late Sir J. Wolfe Barry reaches us just as we are going to press.—

"Due, no doubt, to extra pressure, the obituary notice of the late Sir John Wolfe-Barry in last Thursday's daily newspapers was closely limited to a sketch of his wide-embracing professional career. I ask, however, to be allowed to pay a humble tribute to his remarkable personal characteristics. Sir John always struck me as a peculiarly good example of the finest type of Englishman. His charm of manner and speech were, in themselves, a considerable source of attraction. There were two matters more especially which it was my privilege to periodically discuss with him. In one we were in full agreement; in the other, we took a somewhat different view—perhaps unavoidably; but our discussions were always equally pleasant under either conditions, due largely to his ready forbearance with the outlook of others (even his inferiors) and his natural breadth of mind. Sir John Wolfe-Barry was, indeed, 'great' in every sense; he was one whom we are never likely to forget—partly on account of the lasting value of his work, but also owing to his endearing characteristics.

[illegible]

"The Athenæum, January 29th."

SIR. A. M. RENDEL.—We regret to record the death of Sir Alexander Meadows Rendel, the celebrated consulting engineer, which occurred in London last week at the age of 88 years.

Will.—The late Sir W. H. LINDLEY left £15,088.

NEW COMPANIES REGISTERED.

C. C. Wakefield & Co., Ltd. (149,435).—Private company. Registered January 23rd. Capital, £250,000 in £1 shares. To take over the business of oil refiners, manufacturers of and dealers in lubricating oils and appliances, &c., carried on by Sir Chas. C. Wakefield, Bart., at 30-32, Cheapside, E.C., and elsewhere, as C. C. Wakefield & Co.; also to carry on the business of exporters and importers of lubricants, chemicals, oils, and grease, shipowners, shipping agents, shippers, &c. The subscribers (each with one share) are:—Sir Chas. C. Wakefield, Wakefield House, Cheapside, E.C., manufacturer; W. R. Graham, Wakefield House, Cheapside, E.C., manager; I. Browne, Wakefield House, Cheapside, E.C., secretary. Sir Chas. C. Wakefield is permanent governing director, subject to holding half the issued share capital. Qualification of ordinary directors, £1,000 shares. Solicitors: Bristows, Cooke & Carpmael, 1, Copthall Buildings, E.C.

Pebeo Accumulators, Ltd. (149,429).—Private company. Registered January 22nd. Capital, £1,000 in 1s. shares. Electrical engineers, manufacturers of and dealers in electrical apparatus, &c. The subscribers (each with one share) are:—A. J. Adams, Dennett Villa, 25, Canterbury Road, Croydon, retired; E. F. Ablett, Kintyre, Balgores Lane, Squirrels Heath, Essex, A.M.I.Mech.E.; B. de Quincey, 21, Cannon Street, E.C., solicitor. The first directors are to be appointed by the subscribers. Registered office: 11, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brilliant Arc Lamp & Engineering Co., Ltd.—Charge on proceeds of munitions contract, dated January 11th, 1918, to secure all moneys due or to become due from the company to London & South-Western Bank.

Leon Cornelis, Ltd.—Assignment of £1,182 book debts, dated January 15th, 1918, to secure £1,237 to the Robert Banking Co., Ltd., 265, Strand, W.C. (Note: The Robert Banking Co., Ltd., are directors of this company.)

Siemens Bros. & Co., Ltd.—Trust deed dated January 15th, 1918, to secure £1,330,000 debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital, as a second floating security (subject to £150,000 4 per cent. debenture stock secured by deed of 1900). Trustees: C. C. Macrae and C. B. Crisp.

CITY NOTES.

The Melbourne Electric Supply Co., Ltd. Mr. J. B. BRAITHWAITE presided at the annual meeting on Monday. He said that their local director in Melbourne, the Hon. Agar Wynne, was recently elected a member of the Legislative Council of Victoria, and was now a Cabinet Minister. The year had been an exceptionally difficult one, partly owing to the coal strike in Australia, partly owing to the Daylight Saving Act which was passed but which was subsequently repealed, and partly owing to the increasing difficulty of obtaining and shipping plant and materials and the ever-rising cost of the same. The 6,000-KW. set which he mentioned last year as having been delayed was now completed. A portion of it had already been shipped to Australia and the remainder would probably be dispatched some time next month. When that reached Melbourne, where Mr. Clements, the general manager, had made all arrangements for receiving it, they would feel comparatively comfortable as to the amount of plant they had available. In spite of the strikes and other difficulties, Mr. Clements in his report gave a fairly encouraging view of the general prospect of things in Australia. A matter which the directors had had under consideration during the year was that of the double payment of income tax. He and Mr. Lane, the secretary, had both been serving on a committee which had been formed to deal with the grievance. They had held several meetings and obtained various interviews with the Government, and as a result the Imperial War Conference had passed resolutions which ought to go a long way towards remedying the injustice of which they complained. With regard to the balance sheet, the directors had thought it prudent in view of the increasing difficulties of raising capital here to finance the company for two or three years ahead. They took the matter up early in 1917, and they placed in the United States 1½ million [illegible] per cent general mortgage convertible gold bonds redeemable in 1922. They realised £256,850 at a cost of £18,435, the difference between par and the price actually netted for them. They considered that that capital would enable them to carry on to the year 1920, so that made their minds quite easy in regard to the possession of the capital required for the development of their ever-increasing business. They now had £180,000 of capital in hand ready to meet capital expenditure during the next two or three years. The miles of streets supplied and the new consumers connected were increasing satisfactorily. Last year he pointed out that the tendency was for their existing mains to "thicken out," that was to say, they were obtaining an additional number of consumers on existing mains, which naturally avoided the expense of laying new lines, and rendered the capital already expended more productive. They now had a total of 609 miles of streets in which their mains were available, only 33 of which were added last year, showing an 18 per cent. reduction on the number added in 1916. That meant that they were gradually reducing the new mains that they had to put in year by year to meet the increasing demand upon their supplies. Mr. Clements hoped the present year would show a still further reduction. No less than 61.5 per cent. of the total capital expenditure in connection with the Melbourne undertaking was outside the power house—a most gratifying feature, and a proportion which was almost exactly reversed in the case of British undertakings. The maximum demand on the power-house had increased from 9,000 KW. to 10,500 KW. The consumers at the end of the year totalled over 32,000, which was a remarkably fine figure. There was no London company that could show the same figures. The County of London Electric Supply Co. had the largest number of consumers of any of the London companies, and they did not quite reach that figure. The number of consumers added during the year, in spite of war conditions, was 4,429, a really remarkable result, and very little below that which they had attained in the two or three years immediately preceding the war. There had been an increase of 20 per cent. over that of the previous year in connections for power purposes. The number of H.P. in motors connected was 3,612. The average size of the motors now connected to their mains was 7.3 H.P.; at one time the figure was only 3 H.P. For private lighting they now had 17,297 KW. connected, showing an increase during the year of 12 per cent. They sold for private lighting 5,952,459 units, an increase of 14 per cent. For public lighting they had added 277 KW., an increase of 8 per cent., and they had sold 610,125 units, an increase of 14 per cent. For power supply they had 23,718 KW. connected, an increase of 17 per cent., and they sold 19,571,480 units, an increase of 18 per cent. Other apparatus showed an increase of 21 per cent. in KW. connected, and 36 per cent. in the units sold, and bulk supply showed an increase of 34 per cent. in connections and 36 per cent. increase in the sales. In every case the increase in the percentage of units sold had exceeded the proportion of increase in the KW. connected, showing that those who were responsible for the technical policy of the company were investing the capital wisely and well. Taking their output altogether they had now got 51,309 KW. connected, an increase of 16 per cent., and last year they sold 28,395,000 units, an increase of 19 per cent. for the year. That, he thought, they might consider a very satisfactory state of affairs. Those figures would appear to show that they were doing their duty to the population which they served, and it might well be supposed that they would be left alone, but it would seem that the way in which the company had been developed, and the liberality with which they had treated their consumers of all classes, was increasingly attracting the cupidity of the State and Municipal authorities. It would be within their recollection that when in 1899 they sold to the Melbourne City Corporation the plum of their then business—their mains and undertaking within the city boundaries—the consideration offered them was the statutory power to supply electric light and power in the principal suburbs of Melbourne for a period of 25 years without competition from the municipal authorities. They were thus set the task of building up what was practically a new business over an area of approximately 74 square miles. To that task they at once bent their energies, but during the first few years the shareholders, both preference and ordinary, had to go without dividends, and it was not until 1906 that their gross profit exceeded £10,000, and it was not until 1911 that they were able to recommend the first modest dividend to the ordinary shareholders of 2½ per cent. Since that time, by judicious capital expenditure and a liberal policy towards their consumers, they had made steady and continuous progress, until, on August 31st, 1917, they had expended on the Melbourne undertaking alone close on £1,200,000, and were giving a supply in 598 miles of streets to 34,142 consumers. Their concession had eight more years to run, and they would suppose that, after their long wait for any return on their investment, the shareholders would be allowed to reap the reward of their enterprise and courage undisturbed. Unfortunately, however, that was not the case, and during the last two or three years especially they had had to meet powerful attacks. First, a Bill, called the Greater Melbourne Bill, was brought forward, which if passed would have handed their undertaking over to a municipal authority at six months' notice. That Bill was defeated, but in the following year was revived under a slightly different form, but it again failed to become law. During the year under review a General Tramways Bill was introduced, which sought to confer upon a Tramways Trust to be created the power of compulsory purchase of their Melbourne undertaking upon only six months' notice being given, and upon terms of compensation which, in the opinion of the directors, were entirely inadequate. That Bill, if carried, would, in the opinion of the board, have constituted what amounted to a breach of the contract into which they had entered with the Government in 1899. It would also have presented the absurd spectacle of the entire electric supply in the suburbs of Melbourne being under the control of a tramway authority, while the supply inside the city proper would have remained under the control [illegible] electric supply. Fortunately, that Bill met with little or no support, and was withdrawn by the Government. He mentioned those matters because some hundreds of their shareholders were domiciled in Victoria, where they had an opportunity of exerting the influence they possessed to prevent the serious injustice proposed to be done to them. As mentioned in his speech last year, they were, and always had been, ready to consider taking a supply in bulk either from the Victorian Railway's power house now in course of construction, or from any power house that might be erected for the purpose of developing the large deposits of brown coal which existed in the vicinity of Melbourne, but they did claim that, having entered into a solemn statutory contract in 1899, which they on their part had done their utmost to loyally carry out, the Government on its side should adhere to its part of the contract, and not attempt to interfere with or cut short their already limited connection. As a representative of British capitalists, he could only say that if the Australian State Governments continued to attack private enterprises which were operating under powers which those Governments had themselves conferred, they would render it impossible for them to raise capital for further developments in Australia. The recent action of the Queensland Government in the matter of the Brisbane Electric Tramways Co. was another case in point, and one which, even if defeated, would leave a very nasty taste behind it, and would not soon be forgotten. They had hitherto supposed that in a British Colony, at any rate, a Government's word was as good as its bond, and on the strength of that belief the bulk of the capital needed for the development of Australia had been subscribed; but let that confidence once be shaken, and it would not be soon or easily restored.

Mr. Benjamin Brookman seconded the motion, which was carried unanimously.

Following the re-election of the directors and auditors, a vote of thanks was passed to the local board and the managing director in Melbourne, and the staff and employés.

Adelaide Electric Supply Co., Ltd.

Mr. J. B. Braithwaite, presiding on Tuesday at the annual meeting, said that the continuance of war conditions had resulted in increased difficulty in obtaining and shipping plant and materials and in a rising cost of the same. They had also had the Daylight Saving Act to contend with, an Act which the manager estimated cost them in revenue £2,300. The Act had since been repealed. There had been an unusual number of industrial troubles in South Australia, although he was happy to say that they had never had a strike or a dispute of any kind with their own employés. Amongst other things, there was the big coal strike, which for some time held up supplies of coal, and at one time the position was so acute that the Government instructed them to disconnect certain of their power consumers in order to reduce the consumption of coal, and that had naturally affected their revenue to some extent. In spite of all those facts, the year's operations could fairly be considered as not unsatisfactory, the gross profit having been increased by £8,083, equal to 9.5 per cent. Of the increase in expenses, £5,961 was due to generating costs, almost entirely increased cost of coal. The result must be regarded as very creditable to the local board and staff in South Australia. They had a general reserve fund untouched of £60,000; they had a premium account of £25,425, which could at any time be applied to depreciation if the need arose; and they had their dividend equalisation account of £25,000 still untouched, a portion of which was invested outside the business. That fund was built up some years ago for the purpose of tiding them over any difficult year that might arise, and one would not have been surprised if during the war they had been obliged to have recourse to that account to maintain the dividend; but they could congratulate themselves that they had been able to pull through without touching that money. The general opinion in South Australia was that after the war very great industrial developments were likely to take place in the Port Adelaide district, which was about nine miles from Adelaide. They had been seriously considering the whole position for some time past, and they were quite prepared when the proper time came to put down a power station at Port Adelaide, and probably transfer their main generating station there, where they would have an ample supply of water for condensing. Whenever that time came it was possible that during the period when the Port Adelaide station was being erected there would be a time during which the capital so employed would not have commenced to earn revenue, and the dividend equalisation account would come in very handy in such a case. In regard to the current financial year, they received a cable a few days ago from the local chairman giving them the results of the first four months' working—that was to the end of December. The revenue for that period had amounted to £50,150, as against £44,475 last year, an improvement of about £5,500, while the expenditure for the same period had been £24,850, compared with £22,805, with the result that the profit for the four months stood at £25,300, as against £21,670 for the corresponding period last year. A Royal Commission which had inquired into the question, had reported unanimously against the municipalisation of either the South Australian Gas Co. or the Adelaide Electric Supply Co., so they might indulge the hope that they would be left free to continue the developments of their undertaking. Having referred to the prospective settlement after the war of the vexed question of the payment of double income-tax, the chairman, in conclusion, said that the capital expenditure during the current year was not likely to be heavy, but in order to meet it the local board suggested that, as they could not get leave to make an issue of capital, they would endeavour to obtain the sanction of the Commonwealth authorities to the issue of debenture stock on the local market, and inquiries were being made in that direction.

Mr. R. Percy Sellon seconded the motion, and the report was adopted.

Compagnie Générale d'Electricité. M. Azaria, who presided at the recent annual meeting, in Paris, of the Compagnie Générale d'Electricité, replied at length to questions put privately as to why the company only maintained profits on the level of those realised prior to the war, whereas the manufacturing work carried out since the beginning of the war had been very considerable, and should have been accompanied, it was contended, by an exceptional increase in the profits. Quoting from the statutes, the chairman stated that the company was formed primarily for the supply of light and power, and that the subsidiary companies constituted for this purpose represented the strength and prosperity of the parent company until 1914. Owing, however, to the rise in the cost of raw materials, particularly coal, combined with the contract limitations on the sale prices of energy, the profits of the subsidiary companies in a few months were converted into losses, one having had a loss in 1915-16 of £72,000, a second £34,000 in 1916-17, and a third £33,000 in 1916-17. By developing the manufacturing works, however, the parent company had been able not only to meet the deficit arising from the supply stations, but also to increase the profits to a level slightly greater than that attained in peace time. The only sacrifice imposed upon the shareholders had been to reduce the dividend by one-half in two consecutive years, or, rather, to pass the dividend for one year. The company had been able to raise the dividend to 10 per cent., which was the same as in the last year of peace. The company was not a war creation, but essentially one of peace, and the speaker ridiculed the idea of the so-called fabulous profits which were attributed to many war undertakings, excepting those having a practical monopoly or possessing manufacturing secrets and patents. In the case of the Compagnie Géneralé, the average net profits in 1916-17 did not reach 5 per cent. of the value of the turnover, and although the dividend was 10 per cent. on the nominal value of the shares, it only amounted to 7 per cent. on the average price paid for the 70,000 ordinary shares. The accounts approved by the meeting show that the net profits in 1916-17 were £162,000, as compared with £139,000 in the previous year, exclusive of the balance brought forward, and the dividend is 10 per cent. on £1,000,000, and 5 per cent. on new capital of £400,000.

East London Railway Co.—The report states that the passengers carried last year numbered 9,172,734, against 9,363,822, exclusive of season-ticket holders. There has been a large proportionate increase in the issue of season tickets. At the average rate of 1.27d. for each passenger the traffic from this source alone should now yield approximately £51,700 per annum, without taking into account the increase of 50 per cent. on some of the fares. In accordance with the undertaking given at the last annual meeting, the chairman placed himself in communication with the Treasury to endeavour to obtain some mitigation of the effect of the rules imposed by the Government upon railways under their control in respect of capital expenditure which had not fructified prior to the end of 1913 as applying to the case of the electrification of the railway. Protracted correspondence resulted in the refusal of the Treasury to accede to this request. The net result of this ruling is that, though the general public have enormously benefited by the expenditure in electrifying the line, the shareholders are penalised to the extent of upwards of £3,000 per annum, and will continue to be penalised in respect of the interest on electrification capital until the end of the period of Government control.

Metropolitan Railway Co.—Dividend upon the ordinary stock for the past half-year at the rate of 1 per cent. per annum, making 1 per cent. for the year, carrying forward £16,000, after placing £20,000 to the general renewals fund. Dividend on the surplus lands stock at the rate of 2¾ per cent. per annum, carrying forward £2,500, after placing £3,000 to the reserve account.

Greenwood & Batley, Ltd.—Interim, 7½ per cent. free of tax, on the ordinary shares.

The British Trade Corporation.—The first report of the Corporation shows that during the brief period of its operations a small profit was realised. At December 31st last, the amount of capital issued was £2,000,000. Since the issue of the prospectus in June last the management has been principally engaged in making the necessary arrangements for representation in foreign countries and other business details. It has, however, already been able to render some assistance in connection with overseas trade. Evidence given before various Parliamentary Committees pointed to the desirability of making arrangements for the insurance of commercial credits, and the corporation has in hand a scheme for giving effect to this object. An information bureau has been established. Gross profits amounted to £17,614, of which current expenses, including salaries, rent, rates, office and other charges absorbed £7,943, leaving a net profit, before providing for income-tax, of £9,671.

Stock Exchange Notice.—The Committee has ordered the following to be quoted in the Official List:—

Newcastle-on-Tyne Electric Supply Co., Ltd.—371,881 additional 5 per cent. preference shares of £1 each, fully paid (Nos. 912,333 to 1,284,213).

Montreal Light, Heat & Power Co.—Dividend, 2 per cent. on the paid-up capital stock for the quarter.

Westminster Electric Supply Corporation, Ltd.—Dividend at the rate of 9 per cent. for the year ended December 31st.

City of Buenos Aires Tramways Co. (1904), Ltd.—Balance dividend, 1s. 3d. per share, making 5 per cent. for 1917, less tax.

STOCKS AND SHARES

Tuesday Evening.

The principal market in the Stock Exchange showing any noticeable dulness is that for gilt-edged issues, where prices sag under the influence of a crumbling in the price of the 5 per cent. War Loan, due, of course, to the big subscriptions obtained by the victorious Tanks in the provinces. Most of the general business centres around industrials, and since we last wrote, further attention has been drawn to the shares of the electrical manufacturing companies to the accompaniment of a revival of rumours expecting what may be likely to happen in regard to this group. The Brisbane Electric Tramways matter is once more the hub of vigorous discussion, and the assistance of the Stock Exchange Committee has been invoked to add force to the protest lodged against what are regarded as confiscatory proposals on the part of the Queensland Government in connection with the terms upon which the company is to be taken over.

Well-known firms laid the whole position before a subcommittee of the Stock Exchange, and the latter undertook to bring it to the attention of the full Committee at an early date. The protestors would like to see the authorities in Queensland plainly informed that, if the Brisbane Electric Tramways terms are changed on the lines proposed by the Queensland Government, any further issue made by the Colony, either of Government stock or otherwise, would receive anything but a welcome reception from the London market. There the matter rests for the moment.

Reference was made some time ago to the surprise felt in London in regard to the placing by the Metropolitan Electric Supply Co. of a substantial line of stock in the provinces, without its being offered in the first place to certain houses in the Metropolis. Whatever grievance was felt arose from the fact that the Metropolitan Electric is a London concern, and that in the past it has received support, willingly accorded, from supporters in London. The aggrieved parties considered themselves badly treated when the company placed its latest stock with a group in the provinces, and there may be an echo of this feeling lurking in this week's legislation of the Stock Exchange Committee, which forbids a member of the London Stock Exchange to grant commission concessions to provincial brokers if the latter are shareholders in a concern called the B.S.T., Ltd., so long as this carries on business within the London postal area. The B. S. T., Ltd., is, according to the latest-filed particulars at Somerset House, an undertaking comprised almost exclusively of stockbrokers in various provincial centres, and, although it does not deal actually in stocks and shares, the London Stock Exchange Committee regard the principle of its foundation as sufficiently competitive to make them pass the resolution we have summarised.

Manufacturing shares make a good showing, with a sharp rise in Edison Swan as the outstanding feature. The £5 shares are 7s. 6d. up at 50s., and the £1 shares have risen to 30s. 3d., while British Westinghouse Preference at 2 13/16 are 3/16 higher. Cromptons have improved to 17s. British Insulated Ordinary at 3¼ stand ⅛ higher. Of the cable shares, Callenders and Henleys are 5s. and 10s. up both at 15 and 17 respectively.

Not very long ago a line of shares in Siemens Brothers and Co., Ltd., passed into the hands of the Public Trustee at a price round about £5 per share. We believe that some technical difficulty exists in the way of dealing in the shares, but news reaches us from the

North that buyers are willing to pay 70s. and over, and that a few shares have changed hands on this basis. The nominal value of the shares is £5 fully-paid.

Telegraph issues are firm, with small improvements in Anglo-American Telegraph Preferred and Deferred, Eastern Extensions and a bigger rise in West India and Panama shares. The last-named are 5s. up to 33s. 9d. In answer to inquiries in the market as to what had brought about this sharp recovery, the foolish reply was "only buying." Chile Telephones have improved to 7¼, and United River Plates to 7. Marconis are a better market, with Americans up to 24s. 9d. on hopes of a good report which should be out in a couple of months' time.

In the Home Railway market, Metropolitans went back to 22¾, notwithstanding the dividend, or perhaps because of it, because, as we pointed out before, the Ordinary stock looks over-priced from the yield aspect as compared with the Surplus Lands stock, which pays substantially more. Underground Incomes are ½ down at 81½. An important scheme is proposed for construction of a deep-water wharf at Canvey, and the railway system in connection with it is estimated at 6½ miles in length, to be worked by electric power from a generating station to be erected at Canvey Island. The share and loan capital of the company is to be £1,333,333, and the time stated within which to complete the proposed works is five years from the passing of the Act.

The Rubber market remains dull and heavy, although the shrinkage in the price of the raw material has been somewhat checked. Base metal shares are steady, and prices in the Chemical group after their recent bout of strength have subsided to a slight extent.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price Jan. 29, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	8⅜	—	6 13 4
Chelsea	4	8	2⅞	+ ⅛	5 4 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	+ ⅛	6 5 10
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅝	—	5 5 8

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price Jan. 29, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	95½	+1	6 5 8
do. Def.	33/6	1½	23½	+ ⅛	6 7 8
Chile Telephone	8	8	7½	+ ⅛	5 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15⅛	+ ⅛	*5 6 0
Eastern Tel. Ord.	8	8	150½	—	*5 6 4
Globe Tel. and T. Ord.	7	7	14⅛	—	*4 19 1
do. Pref. ..	6	6	10⅛	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	10	15	3⅛	—	4 16 1
Oriental Telephone Ord. ..	10	10	8⅛	—	3 4 0
United R. Plate Tel.	8	8	7	+ ⅛	*5 14 4
West India and Pan.	6d.	6d.	1 11/16	+ ¼	*2 19 2
Western Telegraph	7	8	15¼	—	*5 5 0

Home Rails.

	Dividend 1915.	Dividend 1916.	Price Jan. 29, 1918.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	22¾	— ¾	4 8 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	81½	— ½	*4 18 2

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916	Price Jan. 29, 1918.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2 13/16	+ ⅛	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	44	— 2	—
Bombay Electric Pref.	6	6	9⅜	—	6 4
British Columbia Elec. Rly. Pfce.	5	5	43	—	11 12 4
do. do. Preferred	Nil	Nil	28½	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	58	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	+1	—

Manufacturing Companies.

	Dividend 1915.	Dividend 1916.	Price Jan. 29, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3¼	—	4 12 4
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	8¼	+ ⅛	6 3 2
British Westinghouse Pref. ..	7½	7½	2 3/16	+ 3/16	5 6 9
Callenders	20	20	15	+ ¼	6 13 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 [illegible]/16	—	6 1 3
Edison Swan, fully paid ..	—	—	2½	+ ⅜	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅛	—	6 14 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19	—	5 5 3
Henley	25	25	17	+ ½	7 7 1
do. 4½ Pref.	4½	4½	4	—	5 12 2
India Rubber	10	10	14¾	—	*6 15 7
Telegraph Con.	20	20	42	—	*5 14 3

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£58	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£38	..
a Copper Sulphate	"	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£18 15/-	15/- inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/-	..
a " Crystals	per ton	170/-	50/- inc.
a Sodium Bichromate, casks ..	per lb.	..	..

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn) ..	"	1/6¾ to 1/7¼	..
g " Bars (best selected) ..	per ton	£147	..
g " Sheet	"	£147	..
g " Rod	"	£147	..
d " (Electrolytic) Bars ..	"	£125	..
d " " Sheets ..	"	£152	..
d " " Wire Rods	"	£133	..
d " " H.C. Wire	per lb.	1/3⅞	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/7¾	½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Electric Furnace for Melting Ferro-manganese.—At a meeting of chemists in Sweden, J. Harden stated that the electric furnace was particularly suitable not only for the production of ferro-manganese, but also for melting it; the use of the crushed solid alloy is apt to give rise to "ghost lines" in the steel, a serious defect owing to the hardness of these spots, which renders the steel unsuitable for machining, so that it is far better to add the alloy in the molten state, ensuring its diffusion through the body of the liquid steel. The ease of control of temperature afforded by the electric furnace, and the avoidance of loss of material which it ensures, render this the best means of melting the alloy. Any type of furnace will serve, but the induction type is the most economical. The cost of operation is about 20s. per ton of ferro-manganese. In addition to the even temperature maintained, there is a considerable economy of time and material, important items, especially with ferro-manganese at its present price of £75 per ton.

Corrections for the Pentane Lamp.—We have received from the Electrotechnical Laboratory of the Department of Communications, Tokyo, Japan, a pamphlet on the correction factor for water vapour in the use of the pentane lamp, by Messrs. K. Takatsu and M. Tanaka. A large number of experimental data are given, and the authors conclude that the complete formula for their pentane lamp (made by Chance Bros., and certified by the N.P.L.) as checked against the Ediswan-Fleming lamp (also certified by the N.P.L.) is:—

$$I = 10{\cdot}0_2 + 0{\cdot}063_5 (8 - \epsilon) - 0{\cdot}008 (760 - b),$$

where I = the candle-power, ϵ the litres of water vapour per m.^{3} of air, and b the barometric pressure in mm. of mercury. This result is practically identical with that obtained by Messrs. Paterson and Dudding at the National Physical Laboratory in 1915, but Messrs. Rosa and Crittenden at the Bureau of Standards, in 1914, obtained the value 0·0057 instead of 0·0063 for the water vapour correction factor. The authors by experiment have found that the use of a ventilating hood and duct above the lamp reduces the candle-power materially; such a device was employed at the Bureau of Standards but not at the N.P.L., and the candle-powers measured at the Bureau were much below the normal value. The authors consider that the discrepancy was due to the use of the ventilating device, and suggest that the same cause may account for the lower correction factor obtained at the Bureau.

Exports and Imports of Electrical Goods during October, November and December, 1917.

The official returns of electrical export and import business for the last three months of the past year, show, under the adverse circumstances, a surprising firmness in export values, while the import totals have been steadily mounting upwards during the past five months. The export totals have been: October, £345,365; November, £326,884: and December, £322,615; and these compare with the three preceeding months as follows: July, £394,339; August, £393,882; and September, £288,956.

The export figures call for no particular comment. Machinery exports reached average values, while in October and November, telegraphic and telephonic exports reached considerable proportions, submarine cable to the value of £42,000 being included in the former month, and of £44,000 in the latter. In December, battery exports reached a high level.

The electrical import values for the three months under review were: October, £224,475; November, £254,644; and December, £294,883, these comparing with £218,741 in July; £179,994 in August, and £210,237 in September.

It will be noted that machinery imports attained considerable proportions in November, and especially in December, while all three months have seen increasing battery imports, and in addition a revival of lamp importation, the December glow lamp total reaching £17,517.

The re-exports of foreign and Colonial electrical material has been on a small scale during the three months, the values being: October, £14,296; November, £5,206; and December, £9,541.

Exports and Imports of Electrical Goods and Machinery, October, November and December, 1917.

	October.			November.			December.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£65,214	£53,697	£2,899	£41,680	£48,856	£2,062	£51,667	£37,962	£3,707
Insulated wire and cable (not telegraphic or telephonic)	11,394	1.749	5.308	14,378	1,966	100	23,299	1,669	3.823
Electric glow lamps	10.278	6,083	808	9,379	7,341	290	6,784	17,517	1,085
Arc lamps and parts (not carbons)	4.569	10,680	20	3,692	7,321	—	1,022	2,789	—
Meters and instruments	11,853	4.588	2,485	10.084	2,853	684	9,112	411	167
Electrical machinery (including switchboards and transformers)	137,612	113,283	1,154	127,276	131,577	1,241	141,860	195,341	727
Batteries	10,481	30,107	—	7,557	40,734	40	34,417	35,252	20
Carbons	565	3,098	467	701	7,520	226	790	2,259	12
Telegraph and telephone wire and apparatus...	93,399	1,190	1,155	112,137	6,476	563	53,664	1,683	—
Totals	£345,365	£224,475	£14,296	£326,884	£254,644	£5,206	£322,615	£294,883	£9,541

NOTES ON WELDING SYSTEMS.

By CAPT. JAMES CALDWELL, M.I.E.E., R.E.

(*Abstract of paper read before the* Institution of Engineers and Shipbuilders in Scotland.)

(*Concluded from page* 79.)

Typical Plants.—A self-contained plant for electric welding consists of a prime mover of some kind driving a generator of electrical energy in the form required for the process to be used, and of sufficient output.

For portable plants a petrol or oil engine has the advantages of lightness, small bulk, and requiring little attention. For stationary plants the choice of prime mover is mainly dependent upon economical considerations. In any case, the driving engine should be well governed, and have some reserve power, so that it will not drop speed seriously upon a temporary overload.

The type of generator used must be alternating current for resistance methods, and continuous current for carbon arc methods. For metal arc welding either continuous or alternating current may be used, continuous for choice. The generator should be self-regulating, with a wide range of load, so that the voltage will not fall excessively with momentary large currents. This can be ensured by compound winding in the case of continuous-current machines. The load fluctuations are greatest when only one welding apparatus is served, so that good governing and regulation are of greatest importance for such use, and interpole machines are preferable.

The larger the number of welders in simultaneous use, the more closely the total power needed will approximate to the sum of the average, so that large installations providing for many welders are relatively less costly in regard to power plant than small installations with only a few welders.

If the apparatus is to be connected to a general supply, with direct current, the most important factor to be considered is the supply pressure. Steadying and regulating resistances in series with the arc are necessary to limit the current flowing. A supply at from 100 to 110 volts should be available to overcome the variable resistance of the liquid flux, although less pressure is sufficient to maintain the arc with both carbon and metal electrodes. When the general supply pressure is from 200 to 250 volts it is necessary to use a motor-generator set, *i.e.*, a 100/110-volt dynamo driven by a motor fed from the general supply; or when the pressure is to be halved, a reducer set may be employed comprising two motors of 100/110 volts connected in series, with the welding current taken from the terminals of one machine. The losses by such conversion should not exceed 20 per cent. of the energy actually used by the welders if the use is reasonably continuous.

If the welding current is taken direct from a three-wire system, the supply should only be taken from the "middle" to one "outer" conductor when carbon arc welding is intended, the work, of course, being connected to the middle wire, which should be positive and earthed.

With the metal arc it is not so important to insist on the earthed work negative, which would be the correct connection in that case.

For resistance welding from D.C. supply, a motor-generator must be used, the generator giving an alternating single-phase current. The supply pressure is not important.

With alternating-current supply, single-phase, if the supply pressure is at, or about, 100 volts, it can be connected directly to arc welders with only the necessary regulating resistance in series. If the supply pressure is above 100 volts, it is advisable to transform it to that pressure for metal arc welding, using a static transformer with separate windings and rated for intermittent working. For resistance welding the supply pressure is not material. Each welder has its own transformer, which can be wound on the primary side for any supply pressure.

In the case of a three-wire two-phase distribution, a single-phase supply can be obtained from the two outers. This loads each phase equally, but reduces the "power factor" of the system, as the currents in the outers are out of phase with the voltage in each log, and this may be objected to by the supply authority.

Alternatively, each welder may be connected to one outer and the inner conductor (or to a single-phase transformer if the supply pressure is not suitable for direct use), exactly as in the case of a three-wire continuous current system, Such connections are certain to produce some out-of-balance current between the two phases, which will be in greater proportion the smaller the number of welders connected.

It is not quite so simple to obtain a single-phase current from a three-phase supply as from a two-phase, inasmuch as a transformer must be used with its secondary windings connected up in a particular way. This connection gives currents largely out of phase in opposite senses in two of the phases, which is objectionable both from the production of out-of-balance voltage and the lower power factor resulting.

Welders can also be connected to the separate phases, each of which yields a single-phase current, but the objection to unbalanced loads has to be met.

Before deciding to utilise public supplies on either the two- or three-phase systems for welding installations of any magnitude, it is wise to consult the supply authorities and obtain their assent to the connections to be used.

When continuous current is necessary, as in carbon arc welding, a motor generator must be used to convert the alternating-current supply to continuous.

If the supply is generated on the premises, or supplied through a transformer or motor-generator, one of the leads should be earthed, viz., that to which the work is connected, and in this case only single-pole switches on the insulated side are necessary. An ammeter of suitable range should be placed in each welder circuit.

The flexible leads to electrode-holders require some attention. The conductors should be of fine wire strands, with sufficient length, and arrangement of fittings made to permit freedom of movement without liability to kinks, and the cable protected with tough, durable material, such as "cab-tire" sheathing. In the case of carbon arcs, the last foot or two may be protected from the heat of the arc by an asbestos covering.

When power supply is small compared with the current required for welding, it is usual to employ a substitution resistance and some automatic device to put the resistance into circuit when the arc is broken. Such a provision may be necessary for portable sets when a single welder is supplied by a small generator, as the interruption of full-load current is likely to cause sparking at the brushes and flash over, but, if possible, it is best to have a margin of power. Where a number of welders are supplied from a large machine, such a provision is quite unnecessary.

The regulating resistances used to limit the current must have a sufficient range to suit the variety of work to be done. Some parts of this resistance should be permanently in circuit, *i.e.*, the regulating switch must have no position cutting out all the resistance. This permanent resistance limits the current to a maximum independently of the operator's skill, care, and inadvertence.

The resistance should be protected so that nothing can come into contact with the current-carrying elements, but ventilated and placed in a position where the heat produced will not inconvenience the operator, or cause any fire risk. The actual resistances should be capable of carrying their rated current continuously without allowing a temperature in excess of boiling point.

Repair work requires superior skilled operators, as every job varies. The methods of fixing parts, countering the effects of expansion, ensuring correct relative position in the completed work, finishing in a workmanlike manner, all demand experience and judgment as well as operating skill. Differences of thickness, risk of damage by over-heating necessitate the man on repair work being a good all-round mechanic, acquainted with the material, construction and working of the article he is handling. For boiler and ship repairs a boilermaker is suitable; for engine and machinery repairs a fitter will be better after training with the welding apparatus. Repair work is in any case work for a skilled man, and only experience can produce a man suitable for this purpose.

Repetition work is comparatively easy, as the preparation of material, provision of fixing apparatus, &c., will have to be made just as jigs, templates, and tools are prepared for repetition machinery work. Indeed, with resistance-contact welding the operator has little to do but see to the supply of material and watch the product from time to time. As the switching on and off of the current is automatic in such cases adjustments can be made by a charge-hand exactly as tool-setting is done on automatic machine tools.

More knowledge and experience is demanded for a "general purpose" resistance-welding set, especially if the operator has to change the clamps and adjust the movement and current regulation for varying sections and sizes.

With any form of gas welding or arc welding manipulative skill has to be acquired. The correct adjustment of gas mixture, correct position of flame in respect to the work, and the welding rod in the one case; the regulation of current, proper length of arc, correct position and distance of electrode in the other, have to be learnt. Further, the operator must watch the work, know the indication of true union of the fused metals, learn to weld from the bottom upwards, how much metal can be added in each layer, the proper rate of advance and swing of the blowpipe or electrode. All this can be taught to an intelligent youth or girl in a very few weeks sufficiently to make them useful operators on a single repetition process.

Perhaps the most important qualifications are watchfulness and perception, which enable the operator to detect anything abnormal in the product or in the tool itself, and thus prevent the output of faulty work. This is particularly the case in welding where defective work may be hidden by an apparently perfect surface, and for this purpose periodic examination and testing of work are necessary. Hence, repetition work by any suitable welding process can be carried out under quite similar labour conditions to other repetition work, whilst it offers prospects of development into a skilled mechanic of the abler operators at least as good as those open to machine operators in other trades.

ELECTRIC COOKING AS APPLIED TO LARGE KITCHENS.

At a meeting of the Scottish Local Section of the Institution of Electrical Engineers, in Edinburgh, the paper by Mr. Gillott was discussed. An abstract of the paper appeared in our issues of December 21st and 28th, 1917.

Mr. C. G. Nobbs said that it might be taken under present conditions that electrical maintenance was about one-quarter that of large coal and steam cooking plants. With regard to load factors, it was essential to give quick service; this entailed comparatively high current ratings to ovens, boilers, &c. With well constructed apparatus the running load was only 25 per cent. of the full-load rating. In the case of restaurant type ovens, the full load might be on for 15 to 45 minutes to bring the ovens to working temperatures, while the running load might be on for hours according to the weight of the joints. There was, however, a large diversity factor which tended to increase the load factor. From the great similarity of the load curves given in the paper, one might think these had been selected. From personal experience of cooking schemes, the diversity factor was large, menus varied from day to day for individual installations, and there was also a wide variation in the class of restaurant and the daily menu. Until such time as the supply authority could take on all classes of consumers, it was quite feasible to select or arrange with consumers to give a high resultant load factor and flatten out the curves of diversity. For example, a communal kitchen would complete its cooking at, say, 7.30 to 10.30 a.m., when the cooked food was sent out to distribution centres or handed over the counter at the kitchen. A scheme which he had to deal with recently would cater for 40,000 to 50,000 meals daily, and it was quite feasible in that case so to arrange the menu that roasting and baking work might be done at any time the day before upon a restricted-hour basis. Meat pies and such like might be arranged so as to be suitable for heating up. Potatoes and green vegetables must be cooked on the same day as they were used, and this could be done, with, in fact, most of the cooking, between 7 and 10 a.m. A combined electrical and steam plant for an individual communal kitchen could easily be arranged to give a load factor of 50 to 70 per cent. Apart from this it would be seen that the deep valley in the author's curves between 7 and 10 could be filled in. For individual installations working under normal conditions, the maximum demand seldom exceeded 50 per cent. of the total current rating. In fact, for some jobs with which he had been connected, the transformers installed were but 50 per cent. of the total wattage rating of the cooking plant. An oven he designed for a 50 per cent. load factor for baking 500 loaves per hour, and installed in 1912, gave a temperature rise from 50 to 425 deg. F. in one hour, 600 in two hours, and maintained a gradually rising temperature from 425 deg. at half load. The consumption varied from 1/10 to 1/12 of a unit per loaf, according to the class of bread baked. Mr. F. Fletcher, at the London discussion, mentioned the "desirability of standardisation of electric heating elements, so that they may be obtained as readily as lamps." He quite agreed, but it was not advisable to carry standardisation too far at this present comparatively early stage in electrical cooking, as progress in design might thereby be handicapped. There was no reason why dealers should not stock manufacturers' standardised elements or renewal parts locally in order to save the delay in transit from the makers. Experienced care was necessary for the fitting of renewal elements, and such work should be done by local contractors or hiring authorities. It would be understood that even were elements made as simple to renew as the ordinary incandescent lamp, it was very doubtful whether they would induce the average cook to put her head into the oven, much less attend to screws and nuts, or investigate a breakdown. Where an establishment such as an hotel, restaurant, or institution employed a resident engineer, he would carry the requisite stock of renewal elements. Co-operation between supply authorities, factors, contractors, and manufacturers was most essential for the propagation or organisation of national sales campaigns, for the collection of technical data, education of the public, &c. It was necessary that each supply or hiring authority, apart from advisory committees, should employ a competent man or men accustomed to meeting caterers, chefs, architects, and the like. Purely electrical men seldom made efficient salesmen. Personally, he preferred to train men having had experience in coal, gas, and steam cooking upon the simple electrical data necessary. There was ample scope for consultants in cooking to advise caterers, architects, supply authorities, contractors, &c., upon large schemes, and to answer to 101 questions that arose upon efficient service, load and diversity factors, and tariffs.

Mr. Hardie (Glasgow) gave Glasgow's experiences. With regard to staff cooking, they equipped the first all-electric canteen in Scotland fully a year ago. It was of 56 kw. capacity, designed for 250 workers. It had been an unqualified success. At the moment they were completing three all-electric installations, one for 100 people, 45 kw.; one for 250 people, 70 kw.; and one for 500 people, 137 kw. They had, in addition, an 80-kw. electrical cooking equipment at a large hospital with 300 wounded soldiers and a staff of nurses and servants. The apparatus had been in use for two years, and the average daily consumption was 130 units, or 0.37 unit per person per day. The boiling and heating were all done by steam. In a Government factory in the West of Scotland there was an electrical equipment in four kitchens aggregating 350 kw., where the plant had been running satisfactorily for over a year. Here, also, the boiling and steaming were done by steam. Personally, he was an optimist on the subject of electric cooking, and agreed with the author that the field for electric cooking, and also for industrial heating, had only so far been scratched. If the business was properly handled electricity supply authorities had in electric cooking and heating a source of revenue second only to that derived from power. He was in agreement with the author on the substitution of self-contained element apparatus for boiling, which still continued to be the weak spot in electrical equipment. They had been standing still for years, and it was time they got a move on.

Mr. Smith (Greenock) said that there they had given favourable terms for cooking for almost nine years, the rate being ¾d. per unit, which had only recently been increased by 10 per cent. They had been seriously handicapped in their early attempts by certain classes of apparatus. They had one or two partly electrical kitchens in shipyards, and these had been fairly satisfactory only. The principal defect with the cookers had been in the hot-plate, but the electric grill and baking plate were the most popular pieces on the market, and in restaurants and bakeries had given satisfaction. He suggested that manufacturers should experiment with radiant heat plates instead of the flat-surface cast-iron hot-plate. As to the design of the cooker, he thought it a good plan to have fuses in every element. They in Greenock had had apparatus giving out owing to line earth leakage due to the elements getting wet. He suggested that the problem of putting more than 250 volts on cooking apparatus should be dealt with in the next edition of the Institution Wiring Rules. He thought there might be two separate cookers, one on each side of the three-wire system, while the oven with top and bottom heat was very much superior to the oven with side elements. He did not think the question of first cost should have much effect on the question of the installation of large cookers, and municipalities should offer suitable terms, including maintenance. They had found the hiring scheme for heaters and cookers satisfactory.

Mr. Henderson pointed out that they had found that electric heating had raised the problem of steam. It would be desirable to have some arrangement for abstracting the steam in the form of water at atmospheric pressure, and using the incoming cool air to condense the water. That problem arose in applying electric heating to biscuit baking.

Mr. Mears (Edinburgh) admitted that his experience of electric cooking had been small, but the results had been excellent. The boiling water difficulty still existed, and he suggested that ordinary utensils should be abandoned and self-contained apparatus installed, so as to improve efficiency and prevent breakdowns.

Prof. Bailey (Edinburgh) agreed that the field for electric cooking was large, but he was afraid the average private consumer would be slow in coming on. The first cost was serious to a private person who did not have the turnover which took place in large-scale cooking.

In the course of his reply, Mr. Gillott held that electrical apparatus to-day was reliable. He had been doing electrical cooking for eight years, and the first breakdown had still to happen. In Newcastle there were nearly 300 installations of domestic apparatus. Two men could keep the whole plant running with no fear of being called out at night for repairs. The cost of apparatus for private houses was about £1 a year, and the cost of energy varied from £2 to £4. The average price of cookers was about £15; this was sufficient to cook for eight persons. In his own case, he gave particulars of cost in the Institution *Journal* for 1914, and he then showed that for lighting, heating, and cooking in the house, with four adults and three children, the annual bill, including coal, was £20, or a saving of £4 10s. a year. He was able to run a house of 10 rooms with one maid doing all the work. That represented a saving of £60 a year, as otherwise an additional maid would have been necessary. That alone should be sufficient to induce private people to go in for electric cooking. He did not see why an ordinary ironmonger should not be able to keep a stock of standard elements. Each element must be of the same loading. Larger apparatus would only require more elements, so that the total load of the oven would not present any difficulty. He agreed that the sales engineer should be more than this designation implied. Replying to Mr. Hardie, the author said they supplied energy at ¾d. per unit. At a recent meeting of the directors of the firm of caterers he spoke of in his paper, a resolution was passed expressing their satisfaction with electric cooking, and giving instructions for the catering engineer to look into the question of extending the electrical equipment throughout the whole of their branches. The saving of labour to the firm had been enormous; they knew what the ovens could do, the heat value of electricity was constant, and the same results were always obtained. The hot-plate trouble was not so acute as some people made out. He had found no difficulty in actual working with the voltage, and Mr. Smith's proposal to have two ovens each on 250 volts would mean the ovens being several feet apart, which in practice would be unworkable. He disagreed with Mr. Mears that there was no scope for electric cooking in Edinburgh. If the hotel keepers and restaurateurs were interested they would get the business. With gas at 2s. and electricity at ¾d., the fuel costs were equal. In connection with intallation "A," the manager told him that he removed 3 to 4 lb. of fat from each grill; that saved £1 a day. He gave another figure which Mr. Nobbs could confirm. A caterer doing 700 grills per week paid 6s. for electricity, and recovered 16 lb. of fat, which he sold at 9d. per lb. The grill brought them in a revenue of several pounds sterling per week. In these jobs there was no difficulty about running cost.

Metropolitan Association of Electric Tramways Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, Whitehall, S.W., on Friday, 18th inst., when there were present:—Messrs. Ullmann (East Ham), Slattery (West Ham), Goodyer (Croydon), Hammond (Met. Elec.), Mason (South Met.), and Mackinnon (London United). Letters of regret at their inability to be present were received from Messrs. Harvey (Ilford), Murray (Walthamstow), Stokes (Bexley Heath), Williams (Erith), and Schofield (Leyton). Various matters of interest were discussed.

REVIEWS.

Miniature Electric Light. Edited by B. E. Jones. London: Cassell & Co., Ltd. Pp. 156. 141 figures. Price 1s. 3d. net.

The introduction of the metal filament lamp, which extended the possibilities of electric lighting so widely, immensely facilitated the task of the amateur who wished to set up his own little installation, and in this he was also aided by the development of the small portable accumulator, largely due to its use for ignition on automobiles. But even with the primary cell a great deal can be done with the small tungsten lamp, and this little book, due to contributors to *Work*, will be found very useful by those who have occasion to provide themselves with electric light on a miniature scale.

It commences wisely with a warning that it *must* be miniature, for the running costs of a more pretentious scheme would be exorbitant. After some elementary explanations with regard to primary and secondary cells, circuits, &c., the various types of lamps available are described, with their accessories. The arrangements of lamp circuits, the respective merits of primary and secondary batteries, methods of installation, &c., are then discussed in detail, and various useful applications of small electric lamps are described, after which some hints for home-made accessories are given. The construction of fairly large primary batteries is minutely explained, and a chapter on accumulators follows. Naturally there is some overlapping and duplicating owing to the different sources from which the matter is derived, but this is a minor fault, and the book as a whole thoroughly covers the ground intended.

The Theory of the Submarine Telegraph and Telephone Cable. By H. W. Malcolm, M.A., Ph.D., D.Sc. London: *The Electrician* Printing and Publishing Co., Ltd. Pp. xi + 565. Price 18s. net.

Telegraph and telephone engineers have for long felt the need of a work which would enable them to follow the phenomena associated with the transmission of telegraphic signals or speech over cables. And although several writers have dealt with certain theoretical aspects of the problems, and others have applied their conclusions to practical conditions, yet it is probably a correct estimate of the present position to say, with Dr. Malcolm, that, apart from the researches of Heaviside, very little information could be found available for those who desired to understand the phenomena underlying the working of the submarine telegraph cable.

The original articles, of which the present work is an assemblage, with other additional matter added, appeared in serial form in the pages of a contemporary in 1912, and it will gratify many who were interested in these articles to refer to them now in their present convenient form.

The book is divided into five sections, which deal respectively with introductory matter, periodic phenomena, transient phenomena, methods of telegraphic transmission, and the future progress of cable telegraphy.

The introductory part will be found exceedingly useful, inasmuch as it provides in a brief recapitulatory form the various mathematical processes made use of throughout the succeeding chapters, such as the exponential series, hyperbolic functions, complex quantities, and determinants.

The remainder of the section deals with resistance, inductance, and capacity, and an investigation into the growth and decay of currents in circuits possessing these properties individually and collectively. The author at this point urges upon the student the necessity of clearly apprehending the fundamental difference between telephony and telegraphy—the periodic nature of the former and the transient nature of the latter, as it was the attempt to apply the transient theory to telephony that "led to the imposition of the K.R. law, by which the progress of long-distance telephony was retarded."

The methods of loading cables are fully treated in Chapter V, and formulæ for calculating the effective resistance and inductance of a loading coil are worked out. Interesting comparison is made between continuous and coil-loaded cables.

Chapters VI and VII are devoted to discontinuities and reflections and alternating-current measurements. A brief, but excellent, description of the Franke high-frequency generator, and of the Drysdale-Tinsley A.C. potentiometer is also given.

Chapter VIII will be of special value to telegraph engineers, whose interests have been somewhat neglected by the disproportionate attention bestowed by investigators on purely telephonic problems. As Dr. Malcolm points out, the problem of determining the electrical state of the cable at any point and time is one that has hitherto produced solutions of particular cases, but it is capable of complete mathematical and numerical solution, and this he proceeds to demonstrate.

The insufficiency of the K.R. law as laid down by Kelvin is pointed out, and expressions are given for the "arrival curve" when the data are applied to the San Francisco Honolulu cable. An important contribution is made in this chapter to the theory of leaks, and the increase of speed in working which the existence of a leak secures.

Chapters XI and XII deal with the various methods of telegraphic transmission, particularly that of the sine-wave form.

Chapters XII and XIV discuss the distortion of signals in cables and the methods of overcoming it. Descriptions are given of the Orling and the Heurtley relays. Chapter XV deals with the duplex cables, and Chapter XVI with the loaded telegraph cable.

In conclusion, the author discusses the future of ocean telegraphy, and of the possible competition from the field of "wireless." Reminding the reader that it is on the attenuation constant, and not on the K.R. of the cable, that speed of working depends, he is convinced that, given the exact electrical constants, the telegraph cable of the future can be so designed that at least as great an advance may be hoped for as in the case of telephony, "where such an altogether disproportionate increase in efficiency has been attained without increase of cost."

The volume, as a whole, is indicative of painstaking and careful work, and will unquestionably be welcomed by every telegraph and telephone engineer in this country who is interested in the theory underlying the practical work for which he is responsible. The symbols employed are those of the practical telegraph man—not those of the academic text book. The excellent curves, illustrative of the mathematical results, enable one clearly to visualise what is happening under the given conditions.

Useful appendices furnish the reader with statements of the principal formulæ employed, and tables of effective resistance, inductance, and impedance of standard apparatus, &c., are given. On page 333 "thory" should be "theory," and on page 375 "unchanged" should be "uncharged." The exponents of a number of the expressions throughout the book are badly mutilated, particularly where the solidus is used. The same applies to integration limits.—A. F.

The Elements of Electrical Engineering. By William S. Franklin. London: The Macmillan Co. Price $4.50.

Volume I. Direct and Alternating Current Machines and Systems. Pp. 465 + x. 368 figures.

This volume, the first of a trio dealing with electrical engineering problems, is by an American author already well known to engineers in this country. In the preface it is described as a first course in electrical engineering, covering both direct and alternating-current systems. As a matter of fact, though the greater part of the volume deals with elementary work suitable for such a course, there are some sections of a more advanced character, and which would only form part of a more advanced study.

The book is, speaking generally, characterised by rather more freedom from convention than is usual in English works; this is certainly no disadvantage. Thus we find a preliminary note giving an account of the functions of the various technical societies of America, engineers being urged to join one or more of these. The physical aspect of electrical engineering is also more emphasised than in books issued on this side of the ocean. Throughout the book the bias is strongly towards the machine side of the subject; there is no consideration of such matters as lamps, illumination, cables, or wiring, and instruments are only referred to in a casual manner from time to time.

The first section of the book deals with general principles, chief stress being laid on magnetic work, which is clearly and adequately considered. There is, however, a very interesting chapter on the electron theory, leading up to an account of the use of the electric valve as detector, amplifier, and generator in wireless telegraphy and telephony. In view of the rapid increase in our knowledge of the electron, it has now become essential that qualified engineers should have some knowledge of the subject, and the presence of this chapter may be taken as a sign of the times.

The next section deals with direct-current machines, almost solely from the point of view of operation, little being included with regard to constructional points. There is, however, an appendix dealing with armature windings, though this is of a purely theoretical character, the question of the arrangement of the winding in slots, a most important practical point, not being considered.

The third section deals with the elementary theory of alternating currents, the treatment differing little from that usually adopted in this country.

The concluding section deals with alternating current machines, alternators, converting plant, motors (including induction, synchronous, and commutator types), and transformers being considered.

The treatment throughout the book is clear and accurate, and a special compliment may be paid to the numerical examples which occur (with answers) at the ends of most of the chapters. These are of a varied, and often of an original, character, and if carefully worked will necessitate a considerable amount of thought on the part of the student.

The diagrams are clear and useful, and the only criticism to be made is that when a device, as a field magnet, is illustrated, it is often of a very old pattern. There seems no reason why the point under consideration should not be indicated by a modern arrangement.

The book can be particularly recommended to that large class of men, who, having good practical experience, desire to improve their theoretical knowledge.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

766. "Arrangement of hoisting chains and gear for lifting electrode arms of electric furnaces, &c., and tilting gears and trolley for same." T. A. Mackereth & J. H. Twidell. January 14th.

776-777. "Electro lifting magnets." Steel, Peech & Tozer and H. E. Bowen. January 14th.

787. "Constant-flow gravity-feed apparatus with electric control for steam generators." J. H. Abbink-Spaink. January 14th.

790. "Tools for manipulating shade-holding ring of electric lamps." A. Watkins. January 14th.

809. "Electric welding systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) January 14th.

833. "Tramcar, &c., under-carriages." F. H. Critchley. January 14th.

834. "Tension regulators and microphones." A. Marr. January 15th.

839. "Battery case for miners' electric lamps." A. B. Connolly. January 15th.

855. "Operating electric switches from a distance." A. H. Francks and Electrios Domestic & Street Lighting Co. January 15th.

861. "Electric fans." British Thomson-Houston Co. (General Electric Co., U.S.A.) January 15th.

901. "Sparking plugs." H. G. Longford, W. W. Longford & Sphinx Manufacturing Co., & W. A. Clark. January 16th.

945. "Manufacturing lead linings for accumulator boxes, cistern boxes, &c." J. W. Claughton & W. G. Claughton. January 17th.

951. "Self starters for internal-combustion engines." B. Brooks & W. Holt. January 17th.

958. "Machine switching telephone exchange systems." L. Polinkowsky and Western Electric Co. January 17th.

963. "Automatic telephone systems." A. Rose & G. Simonetta. January 17th.

1,012. "Steadying the arc discharge in electric furnaces." H. Etchells and H. A. Greaves. January 18th.

1,031. "Electric heating apparatus." C. H. Archer, Automatic Telephone Manufacturing Co. & G. W. Simister. January 18th.

1,032. "Electric relays." Automatic Telephone Manufacturing Co. and P. T. Bates. January 18th.

1,047. "Earthing devices for electric oil-break switches." F. Coates, J. Mirrey and A. Reyrolle & Co. January 18th.

1,048. "Control of dynamo-electric machinery." J. C. Wilson. January 18th.

1,050. "Small electric installations." H. Leitner. January 18th.

1,071. "Starting and lighting systems for automobiles." J. Bethenod. June 18th. (France, June 14th, 1917.)

1,073. "Electro-magnetic relays." M. B. Richter. January 18th.

1,075. "Voltage regulating devices." J. Bethenod. January 18th. (France, April 24th, 1917.)

1,082. "Variable-speed generators and storage-battery systems." H. A. Gill (U.S. Light & Heat Corporation). January 18th.

1,093. "Machine switching telephone systems." G. Deakin, L. Polinkowsky & Western Electric Co. January 19th.

1,109. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) January 19th.

1,121. "Ignition devices." F. W. Vickery. January 19th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

13,345. Railway Signalling. M. Davies & D. C. Davies. September 20th, 1916. (112,251.)

13,483. Storage Battery Plates. A. E. White (United States Light and Heat Corporation). September 22nd, 1916. (112,133.)

13,943. Telegraph or Telephone Sets, particularly Portable or Field Sets. F. L. Cork. September 30th, 1916. (112,136.)

15,802. Telegraph Keys. C. N. de Hoedt. November 4th, 1916. (112,139.)

16,567. Apparatus for producing Perforated Strip by Electrical Current Impulses. H. H. Harrison and Creed & Co. November 18th, 1916. (112,141.)

1917.

51. Transmission Dynamometer. F. D. Everett. January 2nd, 1917. (112,169.)

584. Control Gear for Electrically-driven Cranes. W. S. Hubbard. January 11th, 1917. (112,174.)

1,146. Electric Furnaces. G. B. Filmer & J. J. Denton. January 23rd, 1917. (112,177.)

2,674. Fittings or Supporting Combinations for Electric Lighting and other purposes. J. S. Foreman and Drake & Gorham. February 23rd, 1917. (112,195.)

3,347. Spark Plug Intensifiers. O. G. Singer. March 7th, 1917. (112,201.)

3,934. Apparatus for Teaching Signalling in Morse or other Codes. F. W. Green. March 19th, 1917. (112,205.)

4,144. Magneto-electric Machines. O. Pletscher. March 21st, 1917. (112,206.)

4,335. Starting Switches for Electric Motors. British Thomson-Houston Co. & J. Sugden. March 26th, 1917. (112,209.)

9,317. Fire-detecting Wires for Electric Circuits. C. A. Harsch. June 28th, 1917. (112,239.)

10,019. Electric Portable Hand Lamps and the like. N. McLean. February 2nd, 1917. (Divided application on 1,678/17.) (112,240.)

14,896. Sparking Plugs. W. H. Pease. October 15th, 1917. (112,256.)

France.—La Compagnie d'Entreprises Electro-mécaniques is the name of a new company which has lately been formed in Paris with a capital of £40,000.

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BRITISH WATER-POWER.

ELSEWHERE in this issue we reproduce in abstract a paper read before the Royal Society of Arts by Mr. Alexander Newlands, who for a long time has taken a deep and practical interest in the utilisation of British water-power, and has now provided us with a most useful mass of information on this subject, thus rendering a valuable service to the public. We do not wish to over-rate the importance and magnitude of the water-power resources of these islands, and the author himself exhibits native caution in his calculations and estimates; but we fully agree with him, and with some of the speakers in the discussion—amongst whom was Mr. W. M. Morrison, general manager of the British Aluminium Co., Ltd., the largest users of water-power in this country—that much can be done to utilise such resources as we possess for the supply of power to industries established near the localities where they exist, particularly on the west coast of Scotland, where the topographical conditions somewhat resemble those of Norway, with the advantage of a milder climate. Thanks to the remoteness of these districts from densely populated areas, and to the absence of any other mode of utilising the water, the rights should be obtainable at very moderate cost, and the difficulties elsewhere experienced in arranging for the flooding of a valley in order to provide adequate storage capacity should not be met with in anything like the same degree.

As for the variation in power available at different seasons, is this objection ever raised in connection with the agricultural industry, the building trade, or other staple industries of a seasonal character? At no time would the works be altogether idle, and it conveniently happens that the period of low water coincides with the season when the employés would find plenty to do in connection with agriculture, horticulture, afforestation, fishing, &c. Thus the "load factor" of the working population would be maintained at a high figure, and their prosperity would not be in any way diminished by a temporary shortage of power. In this respect, our climate offers some advantage as compared with Switzerland and other countries where the melting of the snows provides the maximum power in the summer time. Moreover, there are various industries dependent upon electrochemical processes which can be conducted on a scale depending on the power available at any time, such as the manufacture of calcium carbide and cyanamide, the fixation of nitrogen, &c., without serious detriment due to a temporary relaxation of output.

We are especially pleased to note that Mr. Newlands and other speakers discussed the subject from the point of view of the public welfare, and with regard to the social benefits to be derived from the establishment of local industries in rural districts. Hitherto the one great question has necessarily been "whether it would pay," from a purely commercial point of view; that time has passed away—the war and its lessons have opened the eyes of all to the supreme necessity of "team working," of placing the national welfare in the forefront. We regret that the exigencies of space prevent us from reproducing Mr. Newlands's remarks on this aspect of the question at length, and we must refer our readers to the original paper. Our only criticism relates to a misunderstanding with regard to the recent report on Coal Conservation, which he shares with an extraordinary number of writers on these questions—namely, his statement that the Committee recommended the substitution of 16 super-power stations for the existing legion. The fact is that the Committee merely suggested the division of the country into 16 *areas*, supplied from large power stations which might number 30 or 40, if necessary, no limit being placed upon the figure; moreover, so far from each of these stations being of the inadequate output of 20,000 H.P., as he states, the Committee urges that *each* of the generating sets should be rated at *not less than* 20,000 H.P., and preferably should be of 50,000 H.P. These points, however, have little bearing upon the subject of the paper, though the fact that Mr. Newlands estimates the total available water-power of the British Isles at something like one million H.P., whilst the Committee looks forward to the addition of 15 or 20 million H.P. with the coal saved under its scheme, shows that at the best we cannot hope to supply more than a small fraction of our power requirements from water power.

In this connection it is worth remembering that the cost of energy from water power is practically fixed by the capital charges; that is, that it costs little more to supply a 24-hour load than a 1-hour load of the same KW. rating. Hence the value of water-power to industry ought to be estimated not on the KW. capacity of the generating plant, but on the aggregate output in KW.-hours. It should also be borne in mind that when farmers realise the value of the assistance that they can derive from electric power, the small water powers that are scattered about the country will be well worth development for agricultural purposes.

In conclusion, while we are here concerned with British water power only, let us not lose sight of the immense resources of the Empire in this respect, which ought to be, and we hope will be in future, developed by British engineers with British-made machinery. The vast scope that lies before us was briefly indicated by the author and by Sir Dugald Clerk, and we are glad to learn from the latter that the Board of Scientific Societies is collecting information on this subject, which is constantly growing in importance for many weighty reasons.

We may add that in the United States, where the water-power question has for some years been a bone of contention, the importance of finding an immediate solution to the difficulties which have delayed the development of the country's power resources has at last been realised, and President Wilson, in a message to Congress in December last, declared that it was "imperatively necessary" that legislation should be enacted to enable the water-power to be fully utilised. In accordance with this statement, the U.S. Administration has recently introduced in the House of Representatives a new measure designed to incorporate the best points of previous Bills whilst avoiding their defects, and it is anticipated that it will meet with little opposition. At a time when the shortage of coal has become acute, and transportation difficulties combined with bitterly cold weather have culminated in an unparalleled state of chaos on the railways, our American Allies are lamenting the delays which have resulted from divided counsels in their Legislature, but for which the development of their immense natural resources would have placed at their command hydro-electric power of priceless value.

The Board of Trade Tramways Committee.

Amongst the numerous departmental committees which have come into existence during the last few months is the Board of Trade Tramways Committee, to which we briefly referred in our issues of November 15th and 23rd last. The Committee, it may be mentioned, has recently received an additional member in Mr. Jas. Dalrymple, of Glasgow, and is housed at 8, Buckingham Gate, S.W. The duties of this Committee were recently defined by the *Board of Trade Journal* as follows:—

1. To take steps to provide where necessary for the loan or transfer of rolling stock, materials or plant from one undertaking to another.
2. To determine the relative priority of the demands of various tramway and light railway undertakings for necessary materials and supplies, and to make the necessary arrangements in the matter.
3. To deal with questions of new or increased services and the maintenance of existing services, and if considered necessary to make recommendations for the closing of the traffic of any undertaking, either wholly or in part.
4. To consider the question of the construction of new lines or the extension of existing lines, and to make recommendations as to the supply of the necessary materials, plant, &c., therefor.
5. To value the materials and plant which may be released by the reduction of services or the closing of any existing lines, and to advise as to the amount of compensation payable in respect thereof, and the loss in revenue involved, if any.
6. To consider such applications for the revision of existing statutory tolls and charges on tramways and light railways as may be referred to them by the Board of Trade, and to make recommendations as to the action to be taken.

It will be seen that while the Committee is mainly concerned with materials, yet Clauses 4 and 6 confer on it powers of a wider character, in regard to the construction of new lines and revision of statutory charges, and incidentally remind us that a committee of tramway experts such as this might very well be a permanent institution, as it could at least be depended on to show a practical appreciation of the future possibilities of tramway development, and to deal sympathetically with proposals for reviving this rather dormant branch of the electrical industry.

GOVERNMENT PROPAGANDA BY TRAVELLING KINEMAS.

Villagers and townspeople in various parts of Great Britain and abroad will shortly be viewing with interest military lorries initialled B.I.D. (British Information Department), and bivouacked on village greens or market squares, or wherever else an audience may be secured for their work of propaganda by kinematograph on behalf of the British Government and its war efforts. Such work is greatly needed and much overdue, especially abroad, where it will do much to counteract the numerous activities of German agents. Members of both Houses of Parliament have recently inspected these outfits in operation, and most satisfactory results have been achieved.

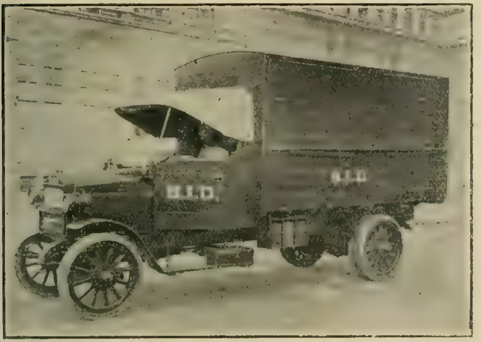


Fig. 1.—The British Travelling Kinema.

Each unit is a self-contained portable picture projection set, and comprises a combined petrol engine and generator switchboard, and projector. These are mounted on the floor of the lorry, which can be drawn up at any desired spot, and with the sides opened out, is at once ready for exhibiting the "movies." The necessary screen can be hung on almost any wall of suitable height, or strung between trees or posts. If a hall is available, the projector can be taken inside, a sufficient length of cable being carried to meet any probable requirements of this kind. The switchboard is mounted immediately behind the driver's cab, and the combined bedplate for the engine and generator is fixed parallel to it, and as close to it as possible. The remainder of the floor space is thus available for the projector and resistance, and the two attendants have ample room to carry out their duties. A complete set of spare parts is carried, as well as a folding workshop bench, fitted with heavy vice, soldering equipment, and all tools needed for effecting field repairs, &c. The lorry, fully loaded, weighs 5½ tons.

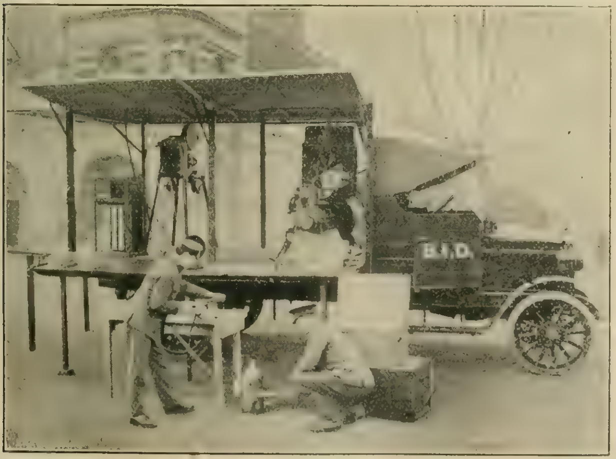


Fig. 2.—Roadside Repairs in Progress.

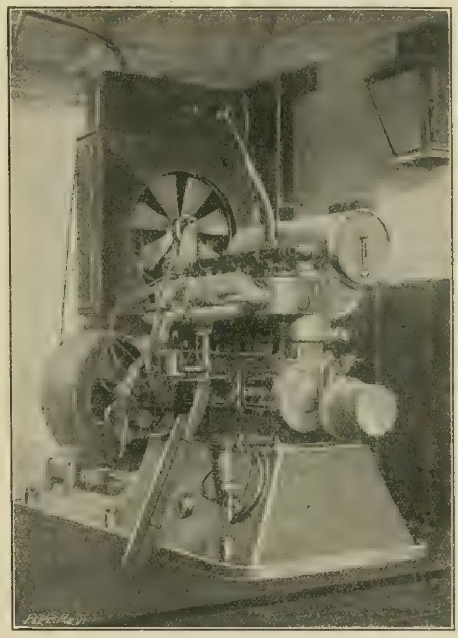


Fig. 3.—Petrol-electric Set.

The petrol engines are four-cylinder Pelapones, of 12 h.p. at 800 r.p.m., and are fitted with automatic lubrication, whilst the electrical section of the plant is of the G.E. Co.'s manufacture.

The switchboards are substantially made, and all cut-outs are provided with straps to prevent their jarring out. The generators are compound wound, with an output of 100 amperes at 70 volts, and 25 per cent. overload can be borne for two hours.

Kamm projectors of the latest model are used, with a new pattern front type drum shutter. The tests have proved that the pictures shown from the body of the lorries are as rock-steady as those of any modern picture hall. When it is remembered that the generating plant for the projector arc is working on the same floor as the projector itself, and that the whole apparatus is mounted on the relatively unstable foundation of a motor-lorry body, this feature is of special interest, and evidences great care in design. It is believed that no successful results have previously been obtained with an arrangement of this kind. The lorry bodies are of roomy construction, and will act as homes for the various parties, hammocks being provided for sleeping purposes. The roof is fixed, but the sides and back are hinged. The lower halves of the latter are provided with legs, which rest on the ground, whilst the top halves are held up by compasses. The arrangement of these can be varied, therefore, to suit weather and other conditions, either by being fully opened, part opened, or totally closed. The 4-ton Vinet chassis are fitted with special transverse bearers to take the weight and vibration of the generating plant, and four-cylinder 10-H.P. engines, with four-speed gear boxes and worm-driven back axles, are provided. The entire equipments have been completed to the design and under the supervision of Capt. J. W. Barber, of the British Information Department.

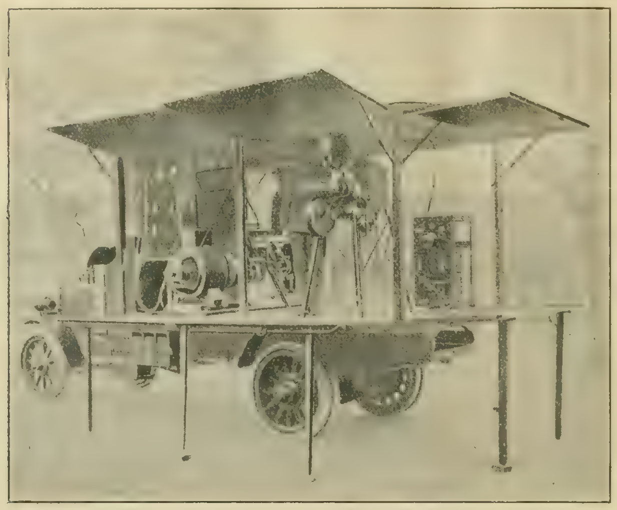


Fig. 4.—Projector in Operation, Showing Freedom from Vibration (exposure 20 seconds).

PROBLEMS OF INDUSTRY.

(*Continued from page* 105.)

The Minister of Labour (Mr. G. H. Roberts, M.P.) in a recent speech expressed the view that the state of the labour market after the war—*after the lapse of a period of reconstruction*—would be so favourable that physically fit men would experience very little difficulty in securing employment, but there must be a display of goodwill and sympathy in securing suitable employment for the disabled solder. Without universal co-operation in this matter grievances would arise.

Mr. Roberts called for "the human touch" to be applied throughout the whole system, and in respect of the discharged soldier of the unfit type it will be our bounden duty to display it. There may be difficulties with those who have never been soldiers at all in this connection, and we shall all require much discretion and a willingness to show the "human touch." Mr. Roberts holds as we do, and as Mr. Hichens undoubtedly does, that too many reformers to-day overlook the necessity of character. There are in our midst to-day, as Mr. Roberts says, men of prominence who are playing with the fires of revolution and pandering to passions—men who fail to perceive that the first essential of real progress is the elevation of the character of the whole people. On the other hand, it is satisfactory to find that there are many minds at work upon the constructive side and not a few of them agree in advocating this "human touch" in industry. Such a "touch" is found by some speakers to exist already. For example, Major Astor, M.P., finds that industry has been "humanised" and greatly changed by the development of co-operation between employers and employed. This great change, however, may not outlast the war. If we have no Prussian militarism menacing our existence that co-operation may be weakened unless the Whitley machinery be set up to give it both a measure of permanence and room for free play. Major Astor expresses the conviction that we must recognise that great changes are upon us. We must recognise it in industry. There is as much responsibility resting upon the reactionary as on the wildest of Bolshevists, for the feeding of the fires of revolution. When we say that Mr. Hichens's ideas are not to be banned on the ground of impractical idealism, we do not fail to see that all leaders of industry are not going to give them their approval either immediately or from A to Z, but they have the merit that they try to hold the balance fairly between Capital and Labour under the altered conditions of life, when the spirit of industrial domination, in so far as it is akin to Prussian militarism, has got to give way to the "human touch" of Mr. Roberts, and to the "humanising of industry" advocated by Major Astor.

Let us now turn to a review of certain steps which the Hichens principles seem to suggest in relation to certain of the outstanding problems with which industry is to-day confronted.

We print the James Watt lecturer's remarks on these points fairly fully, because we believe that only good can result from a close study of them, however much they may run counter to the commonly accepted ideas of industrial authorities. First, it is held that no business is entitled to make unlimited profits, but, of course, no business man would advocate limitation unless the limit were sufficiently high to afford such a return as to justify the investment of capital in industrials. We shall require after the war to offer fuller inducement to capital, rather than less, to come into industry, and the days that will call for the maximum of efficiency from us all will not be times to dampen down initiative in any class. The limitation might be quite possible without the unwise limitation of reward to managers and representatives responsible for progressive business policy and action. The point is what should the limit of return on capital be? You can have no fixed basis for differing businesses, and you must consider it in relation to the reward derived by the workers who so largely contribute to the earning of it, and in relation to the price to the consumer, to serve whom the business exists:—

> 1. The present theory is that the residum, however large it may be, after defraying the costs of production, should go to Capital. This, I submit, is unsound. Labour, the entrepreneur class. Capital and the Consumer, are all partners in the business of the community, and no one class is entitled to benefit unduly at the expense of another. The principle of the profits tax should, therefore, be retained after the war. The present tax, of course, was intended as a temporary measure, and a standard of profits based on pre-war earnings is quite unsuited to permanent conditions. It would be necessary to fix a standard rate of interest for the capital invested in each class of trade or industry, and a proportion (I suggest a substantial one) of any excess profits over that standard should accrue to the State. In any such scheme it would be necessary to provide that adequate allowances are made for depreciation and for reserves to secure the stability and development of business. The wholly inadequate provision for depreciation allowed under the income-tax regulations to-day has, I believe, done serious injury to the industries of this country. It has encouraged over-capitalisation: it has hampered the scrapping of old and the substitution of modern machinery; it has given us a retrogade in place of a progressive standard. . . . Effect must somehow be given to the principle that no section of society is entitled to an unlimited share of the wealth of the community, that free competition has proved an impossible solution, and that profit-sharing with the State which is what, in the effect, an excess profits tax is, is more equitable and more expedient than other forms of profit-sharing.
>
> 2. It follows, secondly, that just as Capital is not entitled to an unlimited reward, but must be checked by State action, so also the reward of Labour must, in the last resort, be determined by the State, as representing the community. Labour has no more right than Capital to make a corner in its own commodity and hold the community up to ransom, and it, too, must bow to the will of the State. In practice it is clear that the tendency will develop for wages to be settled by joint industrial boards representing employers' and workers' organisations, but, in the event of disagreement, or collusion to exploit the community, the State must have the right of intervention. It is not fitting that any party should be the final judge in its own cause, and any such claim, if successful, will inevitably lead to the disintegration of society. For the community will be divided into a number of groups, each fighting for its own hand, private gain will rise superior to the public good, the fundamental law of social life will be broken, and the eternal

truth will be verified that a kingdom divided against itself cannot stand. I recognise that a large section of the community is not, to-day, prepared to accept the principle of State intervention, and I recognise also that unless it appeals to the moral judgment of the great majority of the nation, it cannot be enforced, and ought not to be enforced. The important thing to-day is that the verdict of public opinion should be sought.

3. The principle of national service requires, thirdly, I submit, that the status of Labour, as a whole, should be raised. The workers are clearly entitled to have an effective voice in regard to the general conditions under which their work is carried on. They are vitally interested in all questions, for example, affecting wages, hours of labour, apprenticeship, demarcation of work, decasualisation, and they have an equal right, with employers, to assist in the determination of these problems. The general acceptance of the proposals for joint industrial councils, contained in the Whitley Report, is good evidence that public opinion will support the demand of Labour for an improved status. If its voice is to be at all effective, it follows that, as suggested in the Whitley Report, District Councils and Works Committees must be established to deal with local questions, and to ensure that whatever is agreed to by the Central Councils is carried out locally. The more highly organised Employers' Associations and Trade Unions have already advanced far along the lines of the Whitley Report, but much has yet to be done in determining precisely the powers and functions of these joint central and district bodies.

In the course of his discussion of the first of these points, Mr. Hichens touches upon the causes of Labour's policy of restriction of output which has become so serious a factor at several important stages of the war. The unfair cutting of piece rates has been alluded to by us again and again as being a root cause of that reprehensible practice. We quote again :—

The strongest justification of restriction of output is that individual firms have it in their power to cut down piece-work rates, and in the past they have often done so when they found that under them the workers were earning very high wages. Consequently, the workers have felt that in the end the result of increasing output and speeding up has been to reduce the piece-work rates and restore the normal balance of their earnings: not unnaturally, therefore, they have concluded in favour of maintaining a normal output of work. It is quite clear a mistaken piece rate must be open to revision downwards as well as upwards, and the pledge given by the Government at the beginning of the war that no piece rates should be reduced was a benevolent blunder. During the war some bad individual mistakes have been made, which have reacted on industry as a whole. It would seem, therefore, on all grounds, that the responsibility for fixing piece rates and special time rates—in other words, of the detailed interpretation of wages agreements—should rest, not on individual firms, but on the Joint District Councils which are to be linked up with the Joint Industrial Councils. This would mean that these Councils would require a competent staff of rate fixers to deal with each case promptly, but a more than corresponding reduction could probably be made in the rate-fixing staffs of individuals firms, and the gain that would result from placing the settlement of piece rates on a basis that would establish confidence is incalculable. . . . . Collective rate fixing is the logical outcome of the shop-stewards' movement which has gained recognition.

Concerning the claim that is sometimes put forward that Labour should have an effective voice, not merely in regard to the general policy and conditions of industry, but in the management of each individual business, Mr. Hichens remarks that this claim is vaguely put forward and has never been clearly thought out. He agrees that the general policy and conditions of industry should apply to each firm in an industry, and therefore it is right that Labour should have an effective voice in determining them and seeing that they are carried out, through joint industrial Councils and District Committees, but he observes that every degree of variation is possible in the detailed organisation of individual businesses, and each business should be organised on whatever lines seem best to those who are responsible for its direction. The evils of insecurity of tenure are admittedly great, and every effort should be made to remove "this nightmare of uncertainty which oppresses the wage-earning class"; but the root cause of it is "not the right of the management to employ whom it pleases, but the fluctuation in supply and demand, which can never be wholly controlled," although much more can be done than has ever been attempted. There is sound sense in the remark that: "The secret of success in business lies very largely in the wise selection of men, and if that responsibility is taken away from the management, a blow will be struck at the very roots of our industrial supremacy." We believe that this view must be considered unassailable by the responsible leaders of Labour, though we do not expect it to carry weight with the section [illegible] nt with nothing less than the elimination of the employer and the complete control of industry by "the workers."

From later remarks, it is obvious that Mr. Hichens is not in agreement with the soap-bubble proposal calculated, we think, to be a source of unsettlement, of a six-hours day for Labour as a means of giving employment for all after the war. John Burns's old battle cry of "Eight hours' work and eight bob a day" finds favour with Mr. Hichens, so far as the first part of it is concerned. The times, however, have rendered the latter a very modest pittance, and they have also altered the attitude of many people toward the eight hours demand of 1897. The author regards eight hours as a first instalment toward further reductions, because it is now generally recognised that man is not a mere machine, and lengthy drudgery will not produce a healthy community with leisure for faculty development. Furthermore, our war-time experience has shown that it may be a very false economy to employ men and women after a fatigue point has been reached. Mr. Hickens would go so far as to arrange that each worker, after a year's service with good timekeeping, should have a holiday on full pay, and we believe that this idea will find favour in coming days.

To be continued.

WATER-POWER IN GREAT BRITAIN.

By ALEXANDER NEWLANDS, M.Inst.C.E., Engineer-in-Chief, Highland Railway.

(*Abstract of paper read before the* Royal Society of Arts.)

In this paper the author gives a large quantity of data relating to the rainfall, river discharge, ratio of ordinary to flood discharge, catchment areas, horse-power available, &c., in the British Isles, with references to many sources of information on these points. He points out that each catchment area is a problem in itself, and it is extremely difficult to generalise upon the power possibilities of a whole country even with approximate accuracy.

Scotland.—Scotland, and in particular the Scottish Highlands, being the country north of the Forth and Clyde, possesses larger water power possibilities than any other part of Great Britain.

Over a considerable extent of this northern area the rainfall exceeds [illegible] in. per annum, and it is fairly uniform throughout the year. The country is, however, bare, largely uncultivated, and treeless, so that much of the rainfall is lost in flooding in the rivers.

From the water-power standpoint, the natural lochs, many of them of large area, and at very considerable elevation, are of extreme value. They act as regulators to the rivers in dealing with the discharge of abnormal rainfall, and, in many cases, are ready to hand for regulation and control as power dams. The Highland area under review extends to, approximately, 12,000 square miles, and the seaboard surrounding it is extremely indented and extraordinarily developed, long sea lochs running far inland, affording excellent facilities and shelter for shipping. No part of it is more than 20 miles from the sea or the Caledonian Canal.

The following table admits of comparison with the rest of Great Britain :—

Areas having 50 inches of Rainfall and over.

—	Total area.	[illegible] area.	[illegible]	Locality.
	Sq. miles.	Sq. miles.		
Scotland...	[illegible]	11,575	42	Scottish Highlands and Southern Uplands.
England...	50,053	[illegible]	[illegible]	[illegible]
Wales ...	[illegible]	[illegible]	[illegible]	Entire Central area.
Ireland ...	[illegible]	[illegible]	18	Chiefly Donegal, [illegible]

The Bathymetrical Survey of the Scottish Fresh Water Lochs is of the greatest assistance to anyone interested in the water-power possibilities of Scotland. It is much to be desired that a bathymetrical survey of the inland waters of the remainder of Great Britain should be undertaken either by the Ordnance Survey Department or the Hydrographic Department of the Admiralty.

[illegible]

to arrive at an approximate estimate of the water power available in Scotland by the impounding of the discharge from the loch basins, assuming an average rainfall of 12 in.

In every case a loch has been selected for regulation and control as an intake, and the drainage area of it taken as the catchment available. The fall available has been reckoned as that from the intake to the nearest point on the seaboard, or on the route of the Caledonian Canal, or nearest line of railway, these being the localities where industrial works would most readily be laid down.

Of the 12-in. rainfall it is assumed that two-thirds, or 28 in., is available for power, and the figures on the accompanying map represent the power available, assuming that the flow for 24 hours is utilised in 12 hours, the efficiency of the machinery being reckoned at 75 per cent.

If the summer flow of rivers in mountainous districts be 20 cu. ft. per minute per square mile, equal to 4½ in. of rainfall, a total of 14 in. would maintain three times the summer flow in these rivers, but evaporation and absorption would have to be met by the rainfall in excess of 12 in.

In an appendix are given the data from which the powers have been calculated. The map, the data, and the method of calculating the powers are simply an attempt to deal in a general manner with the possibilities of water power existing in the country, and to arrive at an approximate estimate of the amount of such powers.

The powers on the map total up to 375,000 h.p. in round figures. By diversion and linking-up of adjoining catchment areas, and by impounding beyond the extent provided for in preparing the estimate, it may be assumed that for, say, 100 days' supply, 650,000 h.p. is available.

In the Scottish Highlands the largest installation so far laid down is the Kinlochleven works of the British Aluminium Co.

The drainage area is the relatively small one of 55 square miles, but it has no natural reservoir within it, so that the expense of constructing a dam of a maximum height of 86 ft. and of a length of 1,037 yd. had to be faced.

The area had, however, the paramount advantage of a high elevation, the overflow sill of the dam being 1,065 ft. above Ordnance Datum, and the effective head being 920 ft. It has a further advantage in respect of its high rainfall of fully 70 in. per annum, and the water rights were bought outright.

The reservoir has a length of 7½ miles, and an average width of about half a mile. It impounds about 20,000 million gallons of water, sufficient to give an output of 30,000 h.p. for about 100 days. The cost of the works proper was £600,000, or £20 per h.p.

In 1909 Mr. Morrison, manager of the company, stated that the output of the plant was 150,000,000 units per annum. After allowing for interest and depreciation, the total cost of the energy was 0.0625d. per unit on a load factor approaching unity, or approximately, 34s. per h.p. per annum continuous working.

Having developed the power in the Leven basin the company is now asking Parliamentary authority to utilise the Laggan basin. The same company has also 7,000 h.p. installed at Foyers on Loch Ness.

As an example of a small installation, that at Raven's, near Strathpeffer, may be instanced. The water is drawn from a small dam costing little more than an ordinary farm mill-dam, and on a head of 600 ft. develops 120 h.p., and supplies current for lighting and power to Dingwall and Strathpeffer.

There are installations at Stanley, Blair Castle, Loch Rosque, Achnasheen, Evanton Village, Ardross Castle, Fochabers, North Esk, and elsewhere.

Attractive possibilities exist in the stretch of the Caledonian Canal between Loch Ness and Inverness. Loch Ness drains approximately 700 square miles, and the level of it is 50 ft. on Ordnance Datum. The stretch of the canal referred to is the same level as the loch, and by drawing from it such a quantity of water as would not interfere with navigation, 3,000 h.p. for the working days of the year could be got at Inverness.

Loch Luichart, near Strathpeffer, drains 149 square miles of very wet country, and has an area of 1,150 acres. The river falls 125 ft. in a length of 850 yards. Two-thirds of a 42-in. rainfall would, under these conditions, represent 6,000 h.p. on a 12-hour day basis. The outlet of the loch is a narrow rocky gorge, and impounding could be easily and cheaply carried out.

Lochs Morie and Glass, on the east shoulder of Ben Wyvis, are at elevations of 621 ft. and 712 ft. respectively, and the combined powers from them, if developed on the shore of Cromarty Firth, would amount to 12,800 h.p.

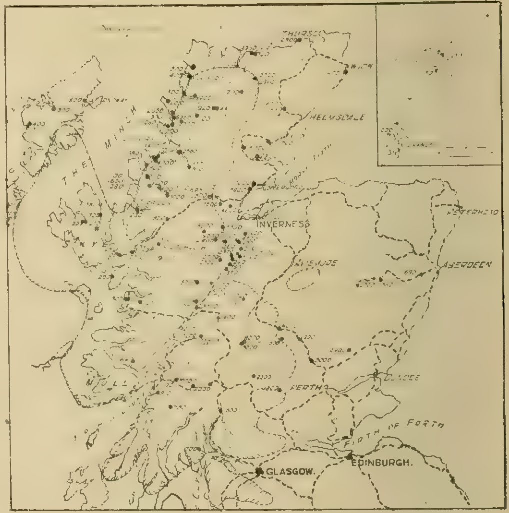
There are considerable and widely distributed possibilities of power development in many rivers and small streams all over the country. The development of small powers from suitable streams is a relatively simple and inexpensive matter. In the case of large rivers, however, it is difficult economically to utilise even a considerable part of the normal flow owing to the cost of dealing with a large volume of water on the low fall normally available. Turbines, for a head of 25 ft., cost £4 per h.p. as against £1 per h.p. for a head of 500 ft. A high fall is the ruling factor in all economically developed power schemes.

If it be assumed that 20 cu. ft. per minute per square mile be available for power, this represents .03 h.p. per foot of fall. A river like the Spey, draining 1,100 square miles, would, therefore, represent on a 15-ft. fall, requiring about a mile of power water flume, 500 h.p. On many reaches of such a river where the fall is much greater and the drainage area less, the power available would, however, be much greater, owing to impounding being possible. On certain large Irish rivers it has been calculated that 50 cu. ft. per minute per square mile is available for power.

Owing to the difficulty in arriving at total powers available directly from river flow, the map shows power obtainable from impounded areas only.

The powers shown on the map total up to 357,000 h.p., and it is believed they are arrived at on a conservative basis. Assuming that these powers are looked upon as a national asset, the development of them to their maximum efficiency should be carried out under statutory control. Unless this be done, the perpetual right to them will be absorbed by private enterprise, and so be lost for all time to the nation. It does not follow that private enterprise should not be encouraged to develop the powers, but this could be done under statutory authority whereby it would be possible for the State to acquire the powers if and when it required them for national purposes, or to buy them up altogether under a pre-arranged basis of purchase, in the same manner as at the inception of the railway movement the Government retained an over-riding interest in all railways.

Such a control could, moreover, ensure that by generating current of the same periodicity at every power station the whole of them could be made to feed into a network of transmission lines. In this way abnormal rainfall in areas widely apart could be converted into power, and not be lost.



Map of Part of Scotland,
showing areas having an average rainfall of 50 in. per annum or more (hatched border line) and available horse-power.

The Ministry of Reconstruction Sub-Committee recommend 16 stations of normally 20,000 h.p., or a total of 320,000 h.p., say, 400,000 h.p.—about what is shown on the map. If carried any great distance the Scottish powers would have to be reduced to, say, 60 per cent. efficiency to allow for conversion and transmission losses, but even then their total would amount to 300,000 h.p. On the other hand, it is doubtful if the cost after development and transmission to existing industrial areas would be less than the cost of power generated there at the pit-head. It may be, therefore, that the sphere of usefulness of these water powers is the region in which they are available, along with a fringe of the adjacent territory to which they could be transmitted. Scottish water power exists in a territory destitute of coal, and it is due to the presence of, or accessibility to, cheap coal that the great centres of industrial activity are located where they are. Shipping facilities also determined their location, but such facilities exist all over the northern half of Scotland.

The extent to which we have neglected the agricultural possibilities of our country is causing anxiety to reflective minds. Only 22 per cent. of the people of Great Britain and Ireland lived under rural conditions. Much of this condition of things is attributable to the centralisation of industry, which has absorbed our rural population to an increasing extent year by year.

Now we have the cry of "back to the land," and a demand for afforestation, which latter undoubtedly offers vast and far-reaching remedial possibilities. Both of these schemes should as far as possible be associated with an industrial development, and where water-power exists this is eminently practicable.

If we are to witness the birth of an industrial-cum-agricultural era in this part of the country, it follows that sufficient Highland water power must be conserved for the purpose. Farming operations generally could well participate in the broadcast distribution of electricity for lighting and power for all the operations carried on in the field and in the farm buildings.

The real advantage of combining industry with agriculture on any scheme of land settlement is that the industrial employment supplements the living on the croft or small holding, which of itself will not provide a sufficiently remunerative and attractive livelihood.

Dr. Scott, Professor of Political Economy, Glasgow, in a report to the Scottish Board of Agriculture, strongly advocates the initiation of a scheme of home industries using power in the Highlands.

Mr. E. A. Ashcroft, speaking at the Institution of Mining and Metallurgy, says there are in the extreme north-west of Sutherlandshire, and within reach of admirable shipping facilities, 12,000,000 tons of pegmatite in intrusive veins of a total width of a quarter of a mile, ideally situated for open quarrying operations. He estimates that from a plant which he specifies 50 tons a day of 80 per cent. potassium muriate could be obtained, equal to what is obtained from all the 300 blast furnaces in the country put together. These Scottish deposits would alone suffice to maintain twice such an output for 50 years at a cost not exceeding £7 a ton, and not more than £15 to £20 a ton even under war conditions.

Graphite exists more or less freely in several localities. Molybdenite and chromite are also to be got; steatite exists in various localities, and the Skye diatomite is well known. The iron, consisting largely of brown hematite, at Tomintoul, is worth mention, and the iron deposits in Raasay are now well known. Lead ore is being worked at Georgemas, and barytas near Lybster, both in Caithness.

England and Wales.—If the figure already arrived at for Scotland be assumed correct, on the same ratio the power for the other countries would be :—

	For 12 hours' daily supply.
England	281,000 H.P.
Wales	109,000 H.P.
Ireland	359,000 H.P.

The absence of large lochs in England and Wales, and the want of elevation in the country as a whole, severely restrict the possibilities of water-power development.

The direct flow of rivers appears to be the principal source of energy available, and owing to the variation in flow, and for other reasons, no great amount of power appears to be economically available.

The Dee drains 713 square miles above Chester, and by utilisation of the old Roman weir on the river there, the yield from this catchment area is passed through turbines, and appears to develop about 500 H.P. on a fall varying from 1 ft. to 9 ft.

If the average fall be called 5 ft. the power per square mile of drainage area per foot of fall equals 14 H.P., requiring 90 cu. ft. per minute per square mile. The average flow of the Dee at Chester is given as 90,540 cu. ft. per minute = 127 cu. ft. per minute per square mile.

Ireland.—Like England, Ireland's possibilities of power appear to be principally in her great rivers.

A great part of the interior of the country is a flat plateau of varying elevation, but nowhere at any great height above sea-level. In this plateau flow great sluggish rivers which have a steep fall to the sea for the last few miles of their length. This feature of the rivers makes them extremely valuable for power production. The best of the lochs lie in flat arable or grazing country, and the raising of their level by impounding would flood much valuable territory.

Mr. Dick makes an estimate of powers from a number of rivers. The amount of power as given by him is as under :—

"Constant" power	5,916 H.P.
Ten months' power	11,832 H.P.
Seven months' power	23,664 H.P.

Mr. Dick says that the normal flow—*i.e.*, giving ten months' power—may, for areas of 30 square miles and upwards, be taken as 25½ cu. ft. per minute per square mile.

To recapitulate briefly, if we are to pay for this war by acceleration of our industrial activities, any scheme for the broadcast distribution of cheap power is of the utmost importance. Water power provides great possibilities in coalless territory and where coal cannot be cheaply imported.

Any successful policy for an agricultural renaissance must be associated with an industrial policy, and utilisation of water power and afforestation are pre-eminently attractive from this point of view.

The rural homes throughout the country are occupied by old people, maintained by their sons and daughters employed in the great cities, and unless the younger generation be found remunerative and attractive employment where they are born they will not settle down there. Moreover, the poverty of our rural districts has been for long attracting attention, and unless something be done which will increase the rateable value there, it looks as if taxation for public services, such as education, poor, roads, sanitation, &c., will eventually have to be met by the State.

In an appendix the author gives abundant data regarding the Scottish lochs, drainage areas, fall available, and power possibilities. His approximate formula for calculating horsepower is $AH/3$, where A = catchment area in square miles and H = fall utilised in feet.

In the discussion, Mr. C. S. Meik said that in the eastern part of the Highlands 42 in. of rainfall was high, but that figure was very low indeed for the western shores of Scotland. There were districts west of the Caledonian Canal where the average rainfall was over 100 in., and at Kinlochleven, farther south, it was 86 in. It therefore followed that the water power available on the western coast would be very much more than in the interior. He did not see how small powers could be developed to advantage, especially inland, unless the power was going to be transmitted to a town. On the western shores of Scotland he thought there was every possibility of large developments in the future, because the use of power to any extent involved the conveyance of raw materials, and those materials could be conveyed much more cheaply by sea than by railway or any other means.

Mr. W. Murray Morrison did not agree with Mr. Meik with regard to small powers, but thought there were a number of industries which might very well be set up to utilise smaller powers, by which he meant 3,000, 4,000, and 5,000 H.P. With regard to the employment of labour, he believed that the establishment of such installations in the Highlands of Scotland was the key to the situation which politicians had been striving to find for many years past, because it would lead to an increase in agriculture, fishing, and other industries, including afforestation, which would need serious attention after the war. He did not agree with the author's plea for the nationalisation of the water power in this country; if private manufacturers were encouraged to extend the use of water power, progress would be very much more rapid.

Sir John Benton thought the Government should make a thorough hydrographic survey of all the waterways in Scotland. Objection might be taken to nationalisation, but a proper survey of the water powers of this country must be regarded as a national question.

Major-General Sir George Scott Moncrieff thought that, although the development of water powers might be left largely to private enterprise, there should be some co-ordinating influence exercised by the Government to see that the utilisation of those water powers was undertaken on some regular and definite plan.

The Chairman (Sir Dugald Clerk) said that the census of production taken in 1907 showed that in Great Britain at that time 10½ million H.P. was being used in stationary engines of various kinds for the industries of the country, which amounted to a little over 1 H.P. per worker. In the United States of America, in a census of production taken in 1909, the total horse-power used in a similar way was over 23 million, showing that the Americans had developed the use of power to a very large extent. The Conjoint Board of Scientific Societies had been taking an interest in the water power of the British Empire, and a committee had been formed, of which Mr. Newlands was a member, to study the whole question. The committee was trying to obtain information as to the water power of Canada, New Zealand, Australia, India, and South Africa, and had already made some progress in obtaining data from those countries. There was no doubt that within the British Empire there was a very large amount of water power. The author had estimated the water power of Canada at 17,000,000 H.P. The water power available in New Zealand appeared to be about 7,000,000 or 8,000,000 H.P., and even Australia had a greater water power than this country. It did not seem possible, judging by the author's figures, that in England steam power and other engine power could be replaced by water power to any very great extent, but it was necessary in the interests of the future of Great Britain that coal should be economised as much as possible, and that every available means, including the use of water power, should be adopted in order to lengthen the industrial life of Great Britain.

In reply, Mr. Newlands said that Mr. Morrison was mistaken in thinking that he advocated nationalisation of water power or anything else; he simply wanted it under proper control. Without some Government assistance the development of water power could not make much progress.

In the course of a letter to the *Journal* of the Society on this subject, Mr. Alph. Steiger says :—

"I was told in the discussion of my paper on water power, read before the Institution of Electrical Engineers in 1896, that there was no water power in this country worth considering, especially on account of the irregularity of the water supply. I have been able to shew, and prove by numerous turbine installations with low and varying falls and a varying water supply, for which I am responsible, that a constant and good water power can be obtained under such conditions. I was told that a water power which is varying, would have to be supplemented during part of the year by artificial power, generated by steam, oil, or gas, at an increased capital outlay which would render such a mixed plant unremunerative. It seems to be entirely forgotten that the initial outlay for such auxiliary power forms a relatively small part of the total capital outlay, and that the annual expenses of the hydraulic plant are only slightly increased by the temporary use of auxiliary power required keep up the supply to the demand for power. An absolutely constant power can hardly be found anywhere, and wherever it has been utilised to its full capacity it has been found necessary to add steam plant to comply with the increasing demand, and always to the advantage of the undertaking. I am informed that even at the Niagara power plant steam power is being added.

"In the development of water power the cost is, of course, the first point to be considered. It is generally held that high-fall plants are cheaper than medium or low-fall plants. This is correct only as far as the cost of the turbines is concerned, but long pipe-lines often make high-fall plants even more expensive than medium-fall plants of the same capacity.

"With regard to the economical point of view, the noteworthy fact may be mentioned that in Westphalia, the centre of the German coal industry, whole valleys have been closed by large dams forming artificial lakes for the threefold purpose of regulating the flow of water for navigation of rivers, to prevent flooding, and to obtain power."

ELECTRIC PLOUGHING.

Due to the havoc of war and the claims of industry, the supply of agricultural labour will be quite inadequate to meet the needs of a vigorous agricultural programme, unless mechanical power be used wherever possible to perform duties which were formerly accomplished by manual labour. Suitable equipment must be provided for the purpose, and the interest and the confidence of the farmer must be secured. Also, if electrically-driven machinery is to be used, overland distribution schemes must be inaugurated, or town distributions extended so as to place "ready-made" electrical energy at the disposal of individual farmers. Isolated power plant, consisting of a steam or oil engine (with or without the addition of a dynamo to supply lighting and small power demands), or of a wind or water-driven dynamo, is already used to a considerable extent, and is undoubtedly a valuable aid to the farmer. On the other hand, the arguments in favour of electric driving in workshop and factory, taking energy from the mains of a supply company, apply with even greater force to the needs and circumstances of farmers and machine farming. We have discussed frequently during recent years the general problem of electricity supply for agriculture, and the use of motors for such purposes as preparing fodder, threshing, pumping, and so forth. In the present notes we propose to deal exclusively with the subject of electric ploughing,* this including a number of problems which must be solved if "electricity in agriculture" is to realise its full possibilities.

Ploughing is one of the primary duties of every arable farmer; it is, moreover, a duty which can only be performed during a few months of the year. Relatively heavy machinery and relatively high power are required for its performance. These characteristics are inherently unfavourable—expensive machinery is necessary, which can be used only for a small part of the year. So far as concerns electrical operation, the power demand is relatively high, but the annual load factor is low, and the demand comes at seasons when the station load from other sources is a maximum. Nevertheless, if suitable equipment be used, electric ploughing can be made technically and commercially successful, but it must be emphasised that the difference between one type of equipment and another is sufficient to alter the whole aspect of the problem.

During the last 18 months or so, steam and oil tractors have been used on a very large scale to break up grass land in this country, but, whilst these machines are undoubtedly well suited to emergency application in any part of the country, they do not offer the best means of ploughing our land year after year under normal conditions. For this service a light, electrically-driven haulage equipment offers many advantages. German trials of electric ploughing have been none too successful, owing largely to the use of too heavy and costly equipment.

Power Requirements.—The end to be accomplished is the exertion of a sufficient pull on the plough. Other things being equal, the necessary pull varies with the breadth and depth of ploughing, and may be referred to the basis of so many lb. pull per sq. ft. of section ploughed. Ringelmann's dynamometer tests yield the following values for the specific effort (k) required :—

Light soil	740 to 820 lb. per sq. ft.
Heavy soil	1,125 to 1,230 lb. per sq. ft.
Four-year lucerne	1,780 lb. per sq. ft.
Heath land	1,260 lb. per sq. ft.

If the furrow be l ft. wide and p ft. deep, the horse power required to advance the plough v ft. per second is :—

$$P = k\,l\,p\,v/550 \qquad \ldots \quad (1)$$

This fundamental formula shows that a given area may be ploughed in a specified time by a tool which ploughs a wide furrow at low speed, or by one which ploughs a narrow furrow at proportionately higher speed. The former alternative involves the use of heavy, cumbersome, and costly machines which are difficult to move from place to place, whilst the second alternative is subject to the limitation that the plough cannot easily be steered at speeds exceeding 3 M.P.H., or 4 M.P.H. as a maximum (*i.e.*, 4.4 to 6.6 ft. per sec.).

Suppose that it be required to plough 12 in. deep with a multiple-share plough, ploughing a width of 3 ft. If the soil be heavy and the speed 3 M.P.H., the power theoretically necessary is: $P = 1{,}230 \times 3 \times 1 \times 4.4/550 = 30$ H.P. (approx.). In order to allow for roots, large stones, and losses between motor and plough, it would be wise to provide a 60-H.P. motor in this case. Such a plough would deal (theoretically) with $3 \times 4.4 \times 3{,}600/43{,}560 = 1.09$ acres per hour, or 13 acres per 12-hour day. Actually, one cannot count on more than 65 per cent. utilisation for the day, so that the performance should be about 8½ acres per 12-hour day.

Electric haulages of 75, 90, or even 100 H.P. are sometimes used for ploughing; from 12 to 15 acres per day may then be ploughed, but the equipment becomes costly and heavy.

Systems of Traction.—Whatever the motive force utilised, the plough may be hauled by tractor or winding drum. The great objection to tractors and automobile ploughs in general is the high percentage of the power supplied which goes simply to propel the tractor over what is about the worst possible surface from this point of view. This source of loss is serious enough when breaking up firm grass land, and it may amount to 60 per cent. of the energy supplied in the case of arable land in good cultivation. The net useful tractive effort is limited by the difficulty of obtaining sufficient adherence with the loose soil, which is more damaged (from the farmer's point of view) the heavier the tractor or automobile.

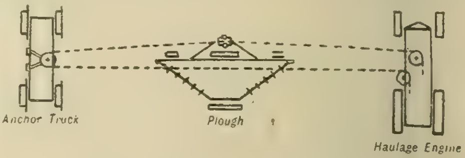


Fig. 1.—Single Haulage-drum System.

Thanks largely to improvements due to Fowler, rope haulage gear is very popular for deep ploughing. Either one or two rope-haulage gears may be used, the general arrangement in the two cases being as shown in figs. 1 and 2 respectively. In the single-gear system, a cable from the haulage drum is fixed to the plough, and returns *viâ* a pulley on an anchor truck at the other side of the field. The haulage gear is of the double-drum type, either drum being connected to the motor whilst the other runs free on the shaft. The driven drum pulls on the cable which unwinds automatically from the free drum. At the end of each furrow the double plough is tilted, and the coupling of the haulage drums is reversed; the tractive pull, which was formerly direct is now taken round the anchor pulley. The double-gear method (fig. 2) employs two haulage gears, which pull alternately on a single cable attached to a double-ended plough.

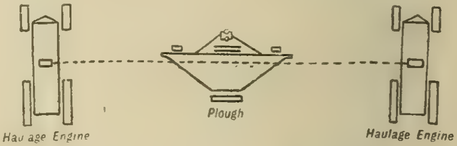


Fig. 2.—Double Haulage-drum System.

Comparing these two systems, the single system offers the great advantage of very much lower capital cost. The anchor truck is very cheap, so that the cost of ploughing tackle is little more than half that of a pair of haulage-gear trucks; also, only one truck has to be supplied with electrical energy, so that there is a saving in the distribution conductors. On the other hand, there is a double length of rope to be provided and kept in repair, the tackle takes longer to adjust than in the case of the double gear, the anchoring for the return pulley may occasion difficulty, and the system is only applicable to flat ground, over which the driver can see the signals of the man at the plough. The double haulage gear system costs more in the first place, but it may be adjusted more quickly than the single haulage gear; also, it is applicable to furrows up to 650 yd. in length, and may be used over uneven ground.

Tractors.—In spite of the fact that they consolidate the ground, and fail to secure the adherence necessary for very high tractive effort, and in spite of the inefficiency of their propulsion, tractors have been used very successfully in ordinary ploughing (6 or 7 in. deep), harrowing, &c. The only electrical equipment of this type which need be described is the Zimmermann electrically-propelled plough, the general arrangement of which is illustrated in fig. 3. Electrical energy is taken from a H.T. line through a step-down transformer car and a heavily insulated trailing cable L (supported on carriages V, V_1, &c., at 50-yd. intervals, and is thus brought to a motor on the plough itself. A chain AB is stretched across the field, and the plough C hauls itself to and fro by means of a toothed wheel engaging with this chain. At each end of the furrow the plough is tilted, and a change-over switch reverses the motor. The chain AB weighs from 1 to 1½ lb. per yard, and needs only a light anchor (say, 75 to 90 lb.) at each end.

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* Basing our remarks on data given by M. Delamarre in the *Revue Générale de l'Electricité*, Vol. I. Nos. 18 and 22.

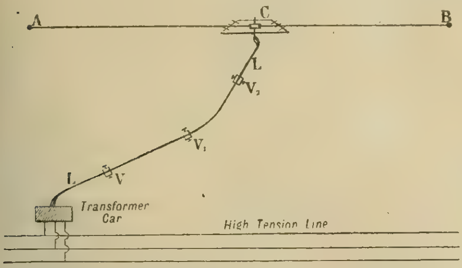

FIG 3.—ZIMMERMANN SELF-PROPELLING PLOUGH.

The "industrial efficiency" of the Zimmermann plough exceeds 50 per cent., and a motor of 15 or 20 H.P. is sufficient. The complete equipment—including 275 yd. of chain, two anchors, 650 yd. of trailing cable, and six carrier trucks for the latter—costs from £355 to £600, according to the H.P. of the motor; Fowler steam haulage equipment costs from five to ten times as much. The cost of ploughing 14 in. deep is about 8s. an acre, if energy costs 1.8d. per KW.-hour. Seeing that this equipment is light, inexpensive, and gives the ploughman complete control over his tool, so that work may proceed at dusk or in fog, it is possible that the system may be received more favourably than it was when first introduced. An improved form of the equipment was introduced in France by M. Maguin, who replaced the flexible trailing cable by a special type of catenary line, from which the plough took current through contact brushes.

Haulage Gears.—At first sight, it seems a very simple matter to mount a haulage drum on a suitable carriage, and then drive it through belting or gears from an electric motor. There were, however, many unsuccessful attempts to build a convenient combination, but now electric haulage gears have been brought to such a degree of perfection (by Eckert, Siemens, A.E.G., Soc. Electrotechnique de Turin, Morelli, Jeumont, and Fillet) that one may say that it is lack of enterprise and sympathy on the part of manufacturers, central-station authorities, and farmers—rather than lack of suitable equipment—which is responsible for the restricted practical application of electric ploughing.

The three types of equipment which may be described as representing modern practice are the Siemens haulage, the Fillet equipment, and a set produced by the Soc. de Constructions du Nord et de l'Est (Jeumont) a few months before the war.

The Siemens Equipment.—This was the first electric haulage set to give real satisfaction in ploughing, and it is used principally in Germany and Spain. One model works in conjunction with an anchor truck at the other side of the field, whilst a second model is designed for use in pairs. The former equipment has two drums for the tractor cable, these drums being driven alternately by the same motor. The chassis is of heavy construction (fig. 4), and carries an enclosed motor of 60-90 H.P., together with starting gear, cable drums, and a change-over coupling.

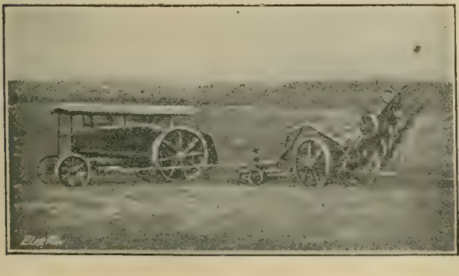

FIG. 4.—SIEMENS PLOUGH AND HAULAGE CAR.

In either type, the haulage drum or drums accommodate 440 to 550 yd. of steel rope, and two haulage speeds are provided, viz., 3½ and 5¼ ft. per sec. (2½ and 3½ M.P.H.). The cable pull is exerted at right angles to the longitudinal axis of the carriage. The motor may be geared either to the cable drums, or to the rear wheels; the carriage is thus self-propelling, and may be turned on a very small radius. An enclosed belt-drive between motor and haulage drum provides for the possibility of the plough encountering roots or large stones; also, it permits the motor to be used conveniently to drive threshing machines, line shafts, and so forth. A tramway-type controller is provided, as well as an oil-immersed maximum and minimum cut-out. A tractive effort of 8,800 lb. can be exerted on the haulage cable.

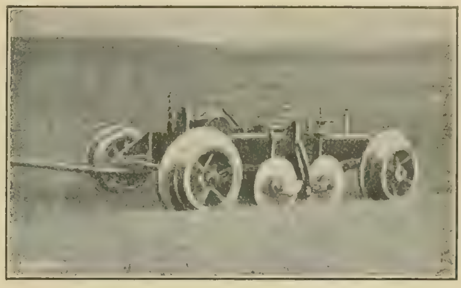

FIG. 5.—SIEMENS ANCHOR TRUCK.

The anchor carriage used with a single haulage truck weighs about 4 tons, and is fitted with disk wheels (fig. 5) in order to secure a sufficient hold on the ground. It is arranged that this carriage is advanced automatically as work proceeds.

The only objection to the Siemens equipment, and unfortunately it is a serious one, is its great weight (about 13 tons), which makes movement difficult, especially over country roads and headlands.

(*To be concluded.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Examinations in "Electrical Installation Work."

Referring to your paragraph on the City and Guilds of London Institute on p. 112 of your current issue, we were specially interested in your remarks relative to the examinations in "Electrical Installation Work."

We read that "The examinations were held for the first time on the revised syllabus," and one might gather from this that things were progressing satisfactorily. But what are the facts?

According to a red-ink slip inserted in the front of the City Guilds' programme for this session, no examinations in electrical installation work are to be held this year "in the event of the continuance of the war." This decision requires to be received with disapproval, and the shortsightedness and *laissez faire* policy of the authorities condemned. In times like the present an extra special effort should have been made to provide the necessary recruits to fill the gaps amongst electrical workmen.

There must be "something rotten in the state of Denmark," either as regards the teaching or equipment of the classes, if with 704 students "in attendance" only 121 candidates present themselves (at 38 centres), and only result in 67 passes. This is an average of 1.75 per centre, and, of course, less than that per class. This is a state of things that the profession and the trade should be ashamed of. A fact that should make them still more ashamed is that the examinations in gas fitting are to continue as usual.

In one sense we are glad that the examiner finds that the practical work shows a lack of adequate equipment, as for several years past we appear to have been more or less alone in thinking this.

Money is spent lavishly on the electrical engineering classes, often on unnecessary and expensive apparatus, while the installation work classes are usually starved, and a pair of pliers has often to serve for a number of students. The other "apparatus" is generally on the same meagre scale. This sort of treatment does not make for enthusiasm amongst the students, and those that "stick it" in such circumstances are to be commended for their staying powers.

With a view to drawing more attention to the whole matter, we have inserted the following question in our current preliminary examination paper in "Electric Light Switching".—

II. If you have never attended classes in the City Guilds' subject, "Electrical Installation Work," or "Electric Wiremen's Work," was it

(a) Because you had never heard of them?
(b) Or because they were too far off?
(c) Or because you thought you had nothing to learn?
(d) Or because you thought the subject was too difficult?
(e) Or because the class was inadequately equipped?
(f) Or what?

If you have attended such a class, say something about it.

We have also just had this question reprinted on separate slips, and shall send it round in various directions. When we have received a good number of answers we propose to analyse and publish the results. Judging from the answers already in hand, the future analysis promises to provide some remarkable revelations.

If any of your readers care to send in answers of their own, with name and address attached as evidence of genuineness (not for publication), we shall be very pleased to receive them.

A. P. Lundberg & Sons.

477-489, Liverpool Road, Islington, N. 7.

[We agree that the decision to suspend the examinations in "Electrical Installation Work" is very regrettable, in view of the present and prospective demand for wiremen. As regards the small number of passes, it should be remembered that many students have been compelled to cease attendance owing to their being called up, and others by the pressure of work thrown upon them.—Eds. Elec. Rev.]

German Influence in the Swiss Electrical Industry.

Referring to the article printed in the issue of your valued paper on February 1st, 1918, pp. 99-100, and especially to the statement in the last paragraph: "Apart from the fact that the author has refrained from mentioning any other Swiss manufacturing companies, it is rather unfortunate, &c.," the writer thinks that this statement might be misinterpreted, and possibly throw some doubt upon works not mentioned in the article.

This, naturally, was not the intention of Mr. E. Tissot, who rather considered it as an axiom that all the world knew that the Oerlikon Co., for instance, required no defence.

It has been the policy of the writer, ever since the outbreak of the war, never to wait until doubt was thrown on the status of his company, but, on the contrary, to invite the widest possible publicity as regards the Oerlikon Co.'s affairs.

He has given all interested Government Departments and his company's *clientèle* the governing factors, and we are so free as to send you herewith a photo of the last statement issued by the Oerlikon Co. in relation to its share composition. It is dated April 12th, 1917, and is similar to previous statements issued on identical occasions. The position therein described is on a par with that existent also previous to the war.

British, Irish & Colonial Dept.,
Ateliers de Construction Oerlikon.
G. Wüthrich, *Manager and Chief Engineer.*

London, W.C., *February 1st*, 1918.

V.B. Cable Breakdowns in the Tropics.

In reply to Mr. D. M. W. Hutchison's letter in your issue of 25th inst., referring to my article in your issue of September 7th, 1917, cables made in the manner referred to have been commercially made and supplied (under the trade name of "Cloida") for the past four years approximately—the date of the patent was April, 1914.

With regard to Mr. Hutchison's question as to results, no instances have been discovered in such cables in the interim of the peculiar deterioration which the method of construction was designed to avoid.

It is only fair to state, however, that this evidence is somewhat negative in character, because—except under extremely severe and usually preventable local conditions, leading to the early establishment of the leakage factor—the kind of deterioration in question takes fully this period to develop.

I have sent Mr. Hutchison a copy of my paper on "Cables" (I.E.E. *Journal*, Vol. LIII, 1914), in which the investigations to which he refers are published in a condensed form, in order that he may have evidence of a more positive character on the subject.

C. Beaver.

Manchester, *January 29th*, 1918.

Rosin Oil.—The Minister of Munitions has called for returns from all persons dealing with rosin or rosin oil, and prohibited dealings except under licence, unless the quantities dealt with are small. Applications for licences are to be addressed to the Controller, Non-Ferrous Metals Supply, M.S.-L., Ministry of Munitions, 8, Northumberland Avenue, W.C. 2.

WAR ITEMS.

Canadian Lighting Economies.—By prohibiting the use of energy for advertising, discontinuing cluster lighting, and reducing street lighting the Ontario Hydro-Electric Commission will save 50,000 h.p.—*Times.*

Trading with the Enemy.—The "London Gazette" for February 1st contains a further list of persons and bodies in the following countries trading with whom is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Colombia, Cuba, Denmark, Hayti and Dominican Republics, Netherlands, Netherland East Indies, Norway, Peru, Spain, and Sweden.

Exemption Applications.—The Ilfracombe Tribunal, on February 1st, considered the cases of the four members of the Ilfracombe Electric Light & Power Co., Ltd., who are of military age. The cases occupied a considerable time, the National Service Representative (Mr. Woodcock) strongly pressing in all cases. Mr. H. J. F. Stewart (the resident engineer and manager) appeared for the company, and stated that over 500 members of the staff of his and the connected undertakings had already joined the Colours, and that the remaining staff was at a minimum. At Ilfracombe they were running with half the number of workmen employed at the declaration of war, and could not spare another man, there being now (excluding stokers) only two skilled men left, one engaged on generation and the other on distribution. The company had used every means to obtain substitutes for these without success. Mr. Woodcock said if Mr. Stewart could get certificates for his men under the Protected Occupations List he would not further oppose. Mr. Stewart pointed out that while giving a certain supply for war work, it was hardly sufficient to justify this course, but that the list of certified occupations covered the men, and on that he asked the Tribunal to give exemptions, unless the National Service Representative could clearly show them that it was in the national interests that the men be taken for the Army, or for other work. The Tribunal adjourned two cases for substitutes and two for re-examination. An interesting point arose over a relief stoker, cleaner, engineman, &c., who Mr. Woodcock claimed could not be classified as a skilled man, though he afterwards admitted he was "semi-skilled." Mr. Stewart claimed that any man that could stoke high-pressure boilers fitted with superheaters and modern grates, mechanical and forced draught, was "skilled," though, admittedly, not so highly skilled as the charge and distribution engineers. Mr. Stewart said it would take "an intelligent labourer" more than a year to learn to carry out the duties of the man in question, and he must ask the Tribunal to exempt the man, the list of certified occupations excepting only "unskilled men," and it did not there state that "only skilled men" were entitled to exemption.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until April 30th to J. Kershaw (37, Class A), overhead linesman, appealed for by the Corporation tramway department.

Hastings Tribunal has granted three months' exemption, subject to his rendering some public service, to J. Kennard (27), motorman on the electric tramways.

After considering appeals by the Potteries Electric Traction Co., Ltd., the Stoke-on-Trent Tribunal has decided that five employés should be released subject to substitutes being found.

The Rochford (Essex) Tribunal has refused exemption to his son (18), appealed for by Mr. J. F. Woodford, electrician, Hadleigh.

At Salisbury, an appeal was made by an electrician's assistant (18, passed for general service). He is engaged at the Porton experimental station at a wage of 25s. per week, and the Chairman said that apparently an electrician's assistant was not so important as a carpenter's labourer doing odd jobs at the same works, and who was paid 30s. per week. It was decided that the Military Representative should try and get the youth's father released from the Army, so that the son could serve in his stead.

At Oldham, the Corporation tramways department appealed for a motorman (33, Grade 2), and he was given exemption until April 30th.

On the appeal of Messrs. T. B. & W. Cockayne, Ltd., exemption until the end of February has been granted to W. Fuller (37, Class A), electrical engineer.

At Oxford, Messrs. Wyatt & Son, of St. Giles's, appealed for the retention of E. P. Green (36), electrician, and two months' temporary exemption was granted.

An electrician (35), appealed for by his employer at Eartham (Sussex), was granted three months' exemption by the East Sussex Appeal Court.

The National Service Representative appealed to the West Kent Appeal Court against three months' exemption granted to H. G. Tomlin (33) and E. Upton (39), both passed for general service, coal unloaders at the Maidstone Borough electricity works. The electrical engineer (Mr. E. E. Hoadley) said that the men were not in the permanent employ of the Corporation, except that they had to unload coal when required. They worked in a gang, and on an average were engaged four days a week. A mechanical apparatus when installed would dispense with the need for so many men, but two months would probably elapse before it was in thorough working order. The appeals were allowed, the men not to report for service for 42 days.

High Wycombe Tribunal has granted six months' temporary exemption to S. F. Root (41, Grade 3), electrician, appealed for by the Marsh Paper Mill Co.

At Leyton, the Urban Council appealed for the retention of four employés in the tramway department. Lieutenant Grevis Pain, for the Military, said that he should not press for drivers, but he must for inspectors. Mr. F. Schofield: But they are motormen first, and then made inspectors. I am working the drivers seven days a week. Two of the men were exempted until substituted; the other two each received six months.

Before the Herts Appeal Court, exemption was claimed by E. F. Chalkley, electrical engineer, of St. Albans. He had been placed in Class A, but appellant handed in a medical certificate expressing the opinion that he should be graded only C 3. Medical re-examination ordered.

An electrician who appealed at Burnley was stated to have been discharged from the Army, but had not been overseas. He was exempted until the end of April.

At Reigate, with the assent of the Military, three months' exemption has been granted to W. P. MacAlpine (38), electrician, magneto repairer, and mechanic, appealed for by the East Surrey Traction Co., Ltd.

At Colchester, five tramway employés, four passed for general service and one in Class C 1, were appealed for. The National Service Representative said that he and the Advisory Committee considered that three of the Class A men were absolutely necessary to the undertaking, and he would assent to their exemption. The other two were given final exemption until the end of March.

At Burnley, an appeal was made for an electrical engineer (30, B 1), 4 ft. 11 in. in height and 89 lb. in weight. He had been rejected on three occasions. The Mayor: The last time he went they just swore at him! The employer said the firm had to keep eight munition works going, and each of these controlled firms could reserve an electrician of their own. Exemption to the end of February, and to be re-examined.

BUSINESS NOTES.

Anglo-Italian Trade Relations.—In the course of an address given to members of the London Chamber of Commerce, at their headquarters in Cannon Street, on February 1st, with reference to our trade relations with Italy after the war, Viscount Hythe said the enormous control which Germany had acquired in Italian industries in the 10 years preceding the war was well known, and this influence enabled them to secure a market in Italy for many of their products, notably machinery. The main lessons from the experience of this war were that every country ought to aim at establishing within its borders all essential industries, of which the most important were agriculture and the manufacture of munitions. Every country would further endeavour to manufacture articles of which she possessed the raw materials. Italy's supply of iron did not meet the national requirements, and she was almost wholly dependent on imported coal. Electric energy might take the place of coal as motive power, but in many branches of manufacture coal and coke were essential. The production of machinery in Italy was limited by the fact that she did not possess iron ore sufficient to supply the needs of her home markets. During the last 30 or 40 years she had built up by means of a tariff an iron and steel industry which more than absorbed the production of iron ore from Elba and the other mines in the country. France and Spain were possible sources of supply for iron ore. Before the war, France exported to Germany 2,000,000 tons per annum. Italians considered that they should be able to secure a proportion of the ore which previously went to Germany, and that a further supply was obtainable from Spain. For steel the United States was the greatest source of supply. The consumption of electrical energy had more than doubled in the last nine years. The number of KW.-hours on which taxation was paid had risen from 1,008,759,868 in 1907-8 to 2,613,395,633 in 1915-16. In view of the enormous difficulties with which Italy had had to contend during the war owing to her dependence on British coal, it was certain that there would be a great increase in the use of hydro-electric power in the immediate future. Projects for utilising the available water power from the Alps and Appenines were in progress, while important organisations had been formed for utilising hydro-electric power plants in Calabria, Sicily, and Sardinia. Owing to German penetration, and to the fact that German banks and German manufacturers took a leading part in the development of the hydro-electric power plants established from 1904 onwards, electrical machinery had been hitherto mainly supplied from Germany or by firms in Italy which were controlled by Germans. Great Britain should be able to supply a considerable proportion of the machinery previously supplied by Germany—*e.g.*, motors and dynamos, as well as electrical fittings and lamps (for which there was a great shortage in Italy at the present time), also material for electric trams and electrification of railways. There were four firms in Italy making electric machinery, viz., Tecnomasio Italiano (late Brown-Boveri), Galileo Ferraris (late A.E.G.), Marelli, and Westinghouse, whilst other companies were preparing to make electrical machinery. The power of production of Italian factories being limited by their dependence on imports for a considerable proportion of their supply of raw material, there was a great opening for British manufacturers in the supply of electrical machinery. The Italian firms above mentioned could not supply the Italian demand.

Having outlined the various steps that should be taken by manufacturers and merchants in this country, Lord Hythe said while it was obviously impossible to develop British trade during the war to any considerable extent, owing to shortage of freight and to the lack of raw material and labour with which they had to contend, it was possible to prepare the ground for the development of trade after the war, and it was of the utmost importance that a beginning should be made on a small scale now, even if this meant some slight restriction on the redundant activity of the Munitions Department. Whether we were going to have Imperial preference or not remained to be seen, but it would be far better for the question to be decided one way or the other now, than to wait until the end of the war for a decision.

Co-operative Effort for Export Trade.—In our issue of December 14th, 1917, we described and discussed the new co-operative scheme for the cultivation of export trade which was proposed by Sir Charles Mandleberg, of Manchester. We are pleased to learn from Sir Charles that the proposal to form a British Manufacturers' Corporation for the purpose of carrying the scheme into effect is receiving the support of manufacturers in all parts of the United Kingdom. The details have now been developed in one or two important directions, notably with regard to the selling arrangements and the extension of banking and other facilities to firms who have not yet embarked on export business. Some of the points set forth in the fresh draft which is now before us are as follows:—

> Members whose business is of a highly-technical nature may prefer to send out a resident representative of their own to do their selling, in which case it would be an undoubted advantage, and would give them confidence, if their representative could refer to the Agent-in-Charge as to the best methods of developing business in that country and for particulars of firms likely to be useful, and their standing. In an emergency such as might arise through illness or other cause, the Agent-in-Charge would be on the spot to act as he might be instructed.
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> In the case of firms who send out travellers, the Agent-in-Charge would be in a position to give the latter the latest information and act in any emergency, as already indicated. It is understood that any information as to possible orders given to any resident representative, traveller, or selling agent would be given at the same time to all such in the same line of business.
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> For manufacturers not yet accustomed to dealing direct with foreign firms, and apprehensive of the risks of such a departure, it will be possible to make arrangements giving them a sense of security and confidence. In addition to having advances by their bankers against bills of lading, where required, they could have their new foreign accounts, where orders are taken from responsible firms, partially guaranteed against loss on this side. Means already exist, of course, for partially guaranteeing foreign accounts in this manner, and these, if desired, could be utilised. This matter has for some time been engaging the attention of the British Trade Corporation, which hopes soon to have a comprehensive scheme to submit.
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> A scheme embracing these points offers advantages to every manufacturer or exporting house seeking fresh markets. With very few exceptions no firm is directly represented everywhere, and every market left unexplored is a neglected opportunity. With the means at their disposal as members of the organisation, the large houses could, at small expense, try out the market in fresh areas. The activities of the new Corporation now suggested would not encroach on the sphere of any known organisation of manufacturers and exporters. Neither would they be in conflict with the objects of the new Government proposals for helping overseas trade, which are to be heartily welcomed. On the contrary, they would be complementary to the Government's efforts; they would supply the business touch and secure the prompt decision and dispatch indispensable in this world of competition, but which, owing to the circumlocution necessarily attendant upon official routine, cannot, with the best will in the world, be attained by way of those efforts alone.

We regret that pressure upon our space in these exceptional times prevents us from detailing the scheme more exhaustively. We recommend firms who are interested in the matter to place themselves in communication with Sir Chas. Mandleberg, at Albion Works, Pendleton, Manchester. In order to carry the heavy financial burdens of the war we must develop our export trade for all we are worth, and if this organisation is likely to furnish small firms or others with facilities for doing that with efficiency and economy, it will merit their support.

Electrical Supplies for South Africa.—The *South African Mining Journal* of December 22nd states:—"There are several Japanese boats at the coast, and they have brought us fair supplies of electrical accessories, which, added to our present stocks, will suffice, as no ordinary job need stand still, providing contractors pay the enhanced prices. The heavier kinds of wiring have advanced about 20s. per coil, such as 7/22 at 48s., 7/20 at 75s., and 7/18 at 85s. The British supplies are coming through practically by every mail, not overmuch at a time but sufficient to show that endeavours are in evidence to keep in close touch with our most important requirements, in the smaller accessories, as distinct from machinery, which is practically non-existent in the British exports. We cannot obtain much relief from America, as their standards are peculiar to their own country and not co-ordinate with the British standards, which no doubt will be made uniform some day."

Tungsten and Molybdenum Wires.—In response to an application by Messrs. Duram, Ltd., under Schedule 42 (1) of the Finance (No. 2) Act, 1915, to the Commissioners of Inland Revenue for an increase of the statutory percentage for Excess Profits Duty, as respects "the business of manufacturing in a malleable form metallic tungsten and molybdenum direct from the ore or from metallic salts, with or without the manufacture of chromium from chrome ore," an Order has been made increasing the statutory percentage in the case of any trade or business carried on or owned by a company or other body corporate to 12 per cent.

Catalogues and Lists.—The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W. 8.—The January issue of the "E.A.C. Quarterly Review" contains "Roll of Honour Notes," particulars of starting characteristics of squirrel-cage motors, slow-motion starters, induction meters, pillar type control panels, &c.

British Thomson-Houston Co., Ltd., Rugby.—Sixteen-page list (No. 4,161) in their standard style and size, giving a fully illustrated description of their ironclad oil-break switchgear type O, form K.

Hilbar Press, 72, Finsbury Pavement, London, E.C. Circulars relating to their dry battery supplies.

Messrs. Ercole Marelli & Co., of Milan, have sent us a set of fac-simile testimonials received from clients to whom they have supplied their electric ventilating fans and blowers and aspirators.

Messrs. Cole, Marchent & Morley, Ltd., Prospect Foundry, Wakefield Road, Bradford.—Sixteen-page illustrated brochure containing a full description of the Spencer-Dawson patent power brakes for tramcars, &c.

British Electric Vehicles, Ltd., Hoghton Street, Southport.—Illustrated circular repecting their B.E.V. electric industrial trucks.

Trade Advisers.—The *Board of Trade Journal* announces that the President of the Board of Trade has appointed three gentlemen to be Trade Advisers respecting the textile, leather and building and furnishing trades. They will be attached to the Industries and Manufactures Department of the Board, and will advise the Board as to the conditions and requirements of their particular trades during the period immediately following the war, and as to any action which it is desirable should be taken by the Board in respect thereto.

Book Notices.—"Liquid Fuels for Internal Combustion Engines." By H. Moore. London: Crosby Lockwood & Son. Price 12s. 6s. net.

"The Training of our Industrial Forces." By H. F. L. Orcutt. London: *Engineering*, Ltd. Price 1s. 6d. net.

Bankruptcy Proceedings.—W. T. Smith, electrical and mechanical engineer, Victoria Street, Bolton.—First meeting was held February 6th, at Byrom Street, Manchester; public examination, February 13th, at Bolton.

Liquidations.—British Autogenous Welding Co., Ltd.—This company is winding up voluntarily, with Mr. L. M. Fox as Liquidator. Meeting of creditors at 268, South Lambeth Road, S.W. 8, on February 8th.

Calendar.—Messrs. Stewarts & Lloyds, Ltd., have again favoured us with one of their very acceptable calendars with monthly slips in a white and gold frame.

LIGHTING AND POWER NOTES.

Accrington.—Price Increase.—In order to meet the increased cost of production, including the increased bonuses awarded by the Committee on Production, the Electricity Committee is increasing the existing charges for current for lighting purposes by 10 per cent.

Australia.—Mr. J. Harper, the Melbourne city electrical engineer, has reported on the experiments made with brown coal since August 14th last, that long series of tests had enabled him to improve the process of combustion to such an extent that brown coal offered no difficulties whatever in its use for the production of electricity on a large scale. The present type of furnace required to be altered, owing to the fact that the production of clinker prevented it from being used more than six or seven hours at a time without the necessity of shutting down for cleaning purposes. To obtain continuous use of the furnace, it was necessary to remove the stationary grate and fit a stepped grate, which would provide for the automatic discharging of ashes and clinker, at a cost of £400. In all furnaces about 2,816 tons of brown coal had been burnt; its consumption had resulted in a net saving of over £500 as compared with New South Wales coal. The Electricity Committee recommended the adoption of the report, which has been agreed to by the Council.

The Sydney Municipal Council has received a report from the city electrical engineer as to the result of the industrial crisis which occurred during August, September, and October last year; although the restrictions placed on the supply of electricity were less stringent in the case of this strike than they were in the one in 1916, the strike last year lasted over a much longer period. It is estimated that the loss incurred during the strike period in 1917 amounted to £47,222, £41,377 being loss of revenue alone.

Barrow.—New Plant.—The Electricity Committee reported that the Ministry of Munitions had sanctioned the ordering of an additional turbo-alternator of from 2,000 to 3,000 kw., together with the necessary auxiliary plant; application is to be made to the L.G.B. for sanction to the borrowing of the necessary amount for the extensions, for which, in view of the urgency of the matter, orders had been placed.

The National Amalgamated Union of Labour has made application for an increase of wages on behalf of all general workers in the gas and electricity undertakings; the application has been referred to the Corporation Departmental Committee for consideration.

Bradford.—Wages.—The result of the ballot of 5,000 Corporation employés on the matter of acceptance of the Corporation's offer of an advanced war bonus or arbitration—as mentioned in last week's Electrical Review—was announced last weekend. The result was a majority of one in favour of arbitration, 2,298 having voted thus, 2,297 in favour of acceptance, 513 declined to vote, and there were 1,227 spoiled papers. On considering this position the War Wages Committee decided that the matter should be referred to arbitration by the Committee on Production so far as the certified undertakings—gas, electricity, and tramways—were concerned. Employés in other departments are to be invited to agree to the matter being referred to the same body. The employés, on Sunday, gave notice to the Chief Industrial Commissioner that there is a dispute pending, and appointed Mr. W. Leach as their representative in the arbitration, which they prefer to be local.

Canada.—According to the *Electrical World*, the Ontario Hydro-Electric Commission is to build a third tunnel at the plant purchased from the Ontario Power Co., and it is expected to develop an additional 50,000 h.p. Work is to commence immediately, and the cost is estimated at 1½—2 million dollars.

Continental.—France.—A company has lately been formed in Paris, with a capital of £240,000, and the title La Société Electrique des Houilleres du Pas-de-Calais, with the object of establishing electric generating stations in connection with the collieries in the district mentioned.

Germany.—At a meeting of representatives of all the central stations in Wurttemberg, it was decided to unite under a single management. The various power stations are to be interconnected, and arrangements made for economical generation and distribution of energy. A Committee is working out details for the incorporation of a separate distributing company to handle the entire production. The Hungarian Parliament has also passed a Bill for combining all the central stations in the country into one organisation. A central management is to control the output and production.—*Electrical World.*

Darwen.—The T.C. has granted a war bonus of 7s. per week to skilled employés in the electricity works and of 3s. a week to other workers.

Derby.—Plant Extension.—The T.C. has approved of a scheme for the extension of the Corporation electricity station by the provision of a 6,000-kw. generating plant, in order to afford a further supply of energy to the works of the British Cellulose and Chemical Manufacturing Co. Application is to be made to the L.G.B. for sanction to the borrowing of £87,000, the estimated cost of the extensions.

Dublin.—Cottage Lighting.—The estimate for the electric lighting of over 200 cottages in connection with the McCaffey Estate Housing Scheme of the Corporation is stated at £1,200, the cost per cottage amounting to £5 18s. 10d.

The Lord Mayor recently reported to the Council that on investigation it was found that in the case of the official who it was suggested owed 10 years' electricity accounts, that the official took over responsibility for these, and, prior to his death, they had been paid regularly for a number of years; the account totalled £378, and £304 had been paid. The bad debts since the Pigeon House works were started had amounted to £250 per annum, or ·35 per cent. of the income, and the cost of collection was ·91 per cent., including accountancy in the rates offices. Attention was drawn to the fact that the Admiralty had arranged with the Dublin United Tramways Co. to supply energy for hay compressing machinery at the Alexandra Dock extension; the opinion was expressed that preferential treatment had been accorded to the company, the Corporation having the sole right of supply in the area. It was agreed that the Lord Mayor should raise the question with the authorities during a forthcoming visit to London.

Extensions.—The Electricity Committee in a special report, is recommending that new generating plant be obtained for the Pigeon House station, to include a 5,000-kw. turbine set, with condensing plant, boilers, &c., at a cost of £60,000; also that a 6-ft. tunnel be built under the Liffey to carry h.t. cables to a new sub-station at North Wall, the cost of the tunnel, mains and sub-station being estimated at £50,000; the Committee also recommends that there should be included in the proposed application to the L.G.B. a sum of £65,000 for distribution work, loans to this amount, however, only to be raised as required.—*Irish Times.*

Dudley.—The T.C. has decided to present a petition against the Bill promoted by the Shropshire, Staffordshire, and Worcestershire Electric Power Co.

Edinburgh.—The Electricity Committee has decided that, in addition to the restrictions imposed by the Ministry of Munitions, it will reserve to itself the right to suspend connections, when necessary, until the plant is extended, and not to make connections where there are gas or other means of lighting or heating.

It is recommended that Dalmeny shall be included in the electric lighting area of the city.

Exeter.—Wages.—The application of the employés of the Corporation electricity department for increased war bonus has been referred to the Committee on Production.

Gainsborough.—Electric Power Station.—Mr. James Marshall has for the present withdrawn his application to the B. of T. for a provisional order for supplying electricity for public and private purposes. Meanwhile, the firm is proceeding with the building and equipment of a large new power station by the Trentside.

Horsham.—Price Increase.—The U.D.C. has decided to increase the price of current as from the March quarterly meter readings.

Kingston-on-Thames.—Plant Extension.—The T.C. has approved of an agreement with the Ministry of Munitions for a loan of £25,000 for a period of 20 years at 6 per cent., and the sanction of the L.G.B. has also been obtained. The loan is for the installation of additional electrical plant and equipment for increased power production for the supply to local firms. The plant will consist of two water-tube boilers, buildings and accessories, two 1,000-kw. steam turbo-alternators with the necessary engine house plant, switchgear, distribution plant, and sub-station transforming gear. *Surbiton Times.*

Lancaster.—Wages.—The local secretary of the Electrical Trades Union has asked the E.L. Committee for an increase of wages of 12½ per cent. The matter is under consideration.

Liverpool.—Year's Working.—The surplus on the working of the Corporation electricity department for 1917 is £100,298, of which £35,298 is to go to the renewals account and £65,000—as last year—to the general rate. It is recommended that in consequence of the various war additions to the cost of production, including the increased bonuses, that the charges for electrical energy be increased as from the end of the present quarter by the addition of 17½ per cent. to the total of all charges now in force, except that for current supplied to the tramways.

The Finance Committee is recommending an increased rate of 1s. 6d. in the £ : the additional demands, it is stated, are mainly due to the increased wages and bonuses to Corporation employés, and the rate is supplementary to the usual assistance from the trading departments, including £125,000 from the tramways and £65,000 from the electricity undertaking.

London.—Southwark.—In view of the recent increase in wages and retrospective expenditure in connection therewith, the Electricity Committee has decided to increase the charges to power, lighting, and heating consumers by 10 per cent., and to charge an additional 33⅓ per cent. to consumers holding contracts not affected by the previous revision of prices, to take effect as and from March 31st, 1918 ; the limit of 20s. in the coal clause is also to be varied from 20s. to 15s. per ton.

Islington.—The Lighting Committee reports that, as officially tested, the cooling towers recently erected do not comply in all respects with the guarantees given by the makers. After negotiations, the contractors have agreed to reduce the contract price by £100, which the Committee has accepted.

L.C.C. — The Finance Committee recommends the Council's sanction to the application of the Shoreditch B.C. for an additional sum of £16,180, the extra cost of the plant required in the modified scheme of extensions, and to agree to the application that repayment of the whole loan (£47,990) may be postponed for a period of two years.

In consequence of the imposition of the 12½ per cent. bonus, in addition to the ordinary war bonus, the City of London Electric Lighting Co., Ltd., gives notice of an increase in the war percentages on electricity supply during the current quarter to 33⅓ per cent. for power, and 25 per cent. for lighting and heating.

Lydney.—The R.D.C. has decided to enter notice of opposition to the Gloucestershire Electric Power Bill. Opposition is also being offered by Gloucestershire C.C. and the Stroud U.D.C.

Salford.—It has been agreed to supply premises now being erected in Pendleton with high-tension three-phase current at 6,600 volts, and a minimum payment to the Council of £600 per annum for five years is guaranteed.

South Africa.—The Cape Town City Council has decided that, having regard to the additional cost of production consequent upon the war, an increase of 10 per cent. be made in all charges for electric current supplied, including minimum charges, except in cases where the supplies of energy are provided under special agreement ; also that the charges for the hire of motors, cookers, heating irons, &c., be also subject to an additional charge of 10 per cent., such increase to take effect from January 1st, 1918.

Owing to shortage of steam power, the Council has for some time past prohibited the extension of light and power installations. The new boiler having now arrived, extensions of lighting and for water pumping only are to be allowed. The Council has agreed to supply energy free for the lighting of the new Troops Rest House and also for the Rest House for Coloured Troops.

At a recent fire at the premises of Messrs. Brimble & Briggs a fireman received a shock from a live wire, which threw him on to the roof and rendered him unconscious for a time.

The Council has approved of a recommendation from the acting city electrical engineer that an all-round bonus of approximately 10 per cent. on the annual salaries of the staff be paid, except the shift engineers, whose case would be met by 5 per cent.

St. Annes.—The output of the electricity works for the year to the end of December was 1,398,130 units, as compared with 968,808 in the preceding year. The greatest increase was in current for industrial power, which rose 197,246 in 1916 to 516,002 last year. There are now 1,924 consumers. In spite of the curtailed supply the December output showed an increase on the previous year.

Stoke-on-Trent.—Linking-up.—The Electricity Committee has confirmed an agreement made between representatives of the Stoke and Newcastle-under-Lyme Electricity Committee with regard to the linking-up of the services, and has decided to apply for sanction to borrow £2,370, the estimated cost of the extension of the mains.

Tasmania. — Hydro-Electric Report. — The third annual report of Mr. J. H. Butters, chief engineer and general manager of the State Hydro-Electric Department for the year 1916-17, contains a lengthy account of the activities, present and prospective, of that department. At the end of 1916 Parliament authorised the expenditure of a further sum of £171,000 for extensions, including a 5-ft. diameter wood stave pipe line, a welded steel pipe line to carry 16,000 h.p. of water, an 8,000-h.p. turbo-alternator set, 7,000 k.v.a. of h.t. transformers, a 4,000-k.v.a. outdoor sub-station for the Electrolytic Zinc Co., at New Town, and a transmission from there to North-West Bay, where another 4,000 k.v.a. sub-station is to be provided for the Hydro-Electric Power and Metallurgical Co.'s carbide works. Contracts were placed for the carrying out of the work, but considerable delay has occurred in securing equipment. Mr. Butters considers it extremely desirable that a complete water-power survey of the State should be made with a view to future developments.

Estimates have already been made of the water power in (1) the upper reaches of the River Ouse, (2) Arthur's Lakes, (3) Lake St. Clair, (4) the River Dee, (5) the Franklin River, and (6) the King River. The latter offers an excellent scheme for developing 40,000 h.p., and in view of the fact that the Mount Lyell Co. would take 25,000 to 30,000 h.p. for the working of the Mount Read and Rosebery zinc deposits which are in the vicinity, and that other companies are prepared to take a share, it is recommended that an early start should be made with the preliminary work.

At the present time hydro-electric activity is confined to the South, and it appears certain that the next development will be on the West Coast ; so far it has not been commercially possible to connect Launceston and the North to the system, an expenditure of £80,000 being necessary on transmission lines. The gaugings at the Great Lake show that 58,000 turbine h.p. has passed the dam continuously during the year, while other subsidiary sources of water bring the total to 65,000 h.p.

Tetbury.—The U.D.C. has decided to oppose the Gloucestershire Electric Power Bill.

Todmorden.—The Corporation, last week, decided to grant an additional war bonus of 3s. 6d. per week to practically all the municipal departmental employés.

Torquay.—The Electricity Committee has decided that no more new connections necessitating the hiring of a new meter shall be made until after the close of the war, owing to the requirements of the Ministry of Munitions. Consumers are asked to use precautions against the overloading of existing meters in order to avoid damages.

United States.—A Bill providing for the improvement of river navigation by private capital, and for the utilisation of the resulting water power, has been passed by the United States Senate. The Bill provides for the improvement of the navigation of rivers without cost to the Government in connection with hydro-electric dams in navigable rivers ; for grants by the Secretary of War of authority for the construction, &c., of such dams ; for payment to the Government for benefits resulting from improvements to headwaters ; for the regulation of rates and service ; for reserving State authority over the waters and water powers ; and for leasing surplus water generated at dams constructed by the Government.

Wallasey.—Increased charges for electricity are to come into operation at the end of the present quarter. The increases are :—Private lighting, from 3⅜d. to 4½d. per unit ; power, from 2¼d. to 2¾d. ; heating, from 1½d. to 2d. ; and traction, from 1·4d. to 1·68d.

West Bromwich.—The Electricity Committee reports that the plant has been installed at the sub-station at Spon Lane. The Council is to lodge a petition against the Shropshire Electric Power Bill, so that the interests of the municipality may be protected. Application is to be made to the L.G.B. to sanction borrowing powers for £1,517 overspent on mains extensions.

Yorkshire Electric Power Co.'s Bill.—The Thurstonland U.D.C. has decided to support the above Bill, and Linthwaite U.D.C. to oppose it ; Rotherham R.D.C. is to petition against the company's Bill, and also that of the Rotherham Corporation. Wakefield City Council and the Kirkburton and Lepton U.D. Councils are holding special meetings to consider the Bill, while the Altofts, Guiseley, Slaithwaite and Thurlstone U.D.C.'s have decided to take no action in the matter. Slaithwaite is protected by a prov. order of its own, and Guiseley has already approved of an application for a prov. order by the Electrical Distribution of Yorkshire.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Tramway Purchase.—The T.C. is applying to the B. of T. for an Order extending for one year the period during which the Council is entitled to purchase that part of the undertaking of the Oldham, Ashton, and Hyde Electric Tramways Co., Ltd., which is within the borough. The Corporation, it is stated, has been unable to come to terms with the company for the purchase, and the B. of T. Order is necessary for its protection. The company's lease of 21 years has now expired. Councillor Judson, in reply to a question, was informed that the object of the request was to enable the Corporation to continue the negotiations, and these would be resumed at once. The resolution would not prevent the purchase of the tramways this year, if terms could be arranged, but if the resolution had not been passed the company could go on another seven years.

Belfast.—TRAFFIC RETURNS.—According to the official returns, the financial state of the Corporation's tramway system is steadily improving, and, indeed, may be said to have turned the corner, the new fares and revised stages being largely responsible for it. The receipts for the mbnth of December came to £32,281, as against £30,036 and £30,683 in the preceding months of November and October. In December the surplus profits ran to £3,242, and if that surplus profit be maintained it will put the tramway finance into a comparatively comfortable position. For the nine months of 1917 ending the 31st ult. the surplus profits were £7,048, as compared with £5,123 in the correspoding period of 1916.

Blackburn.—The threatened tramway strike has been averted. The Tramways Committee has offered to meet the representatives of the tramway employés on the points at issue, and an early meeting is being arranged.

Bradford.—ACCIDENT.—A serious tramway accident recently occurred on the Allerton route, when a car cautiously descending a hill left the track at a curve, and ultimately overturned. The driver was dead when removed from under the car, and 13 passengers were more or less injured. The accident is supposed to have been due to the greasy rails.

Colne.—The T.C. on January 31st adopted recommendations as to improvements and renewals and the relaying of certain crossings and lengths of the Corporation tramway track, which are considered necessary in order to bring the system up to an efficient working condition. It was decided to take steps for obtaining the consent of the Board of Control to the carrying out of the work, which is estimated to cost £3,320.

Continental.—SPAIN.—The Maracena-Atarfe section of the new electric tramway between Granada and Atarfe has just been completed and opened for traffic. The rails were supplied by the Sociedad Altos Hornos de Vizcaya, of Bilbao, while the necessary electric cables were obtained from the United States.

Lancaster.—During the last six weeks the Corporation tramways carried 234,510 passengers, the receipts being £837, against 224,171 passengers, and £730 receipts a year ago. The tramways are now paying.

Leeds.—It is announced that of the men from the Corporation tramways department who are serving in the Army and Navy, 13 have won distinction. One has gained the D.S.O., four the D.C.M., and eight the Military Medal.

Liverpool.—The Corporation tramways department shows a surplus for 1917 of £167,243, of which the Committee proposes to tranfer £42,243 to the reserve, renewals, and depreciation account, and £125,000 to the general rate. The allocation is at the same rate as in the previous year.

London.—L.C.C.—The Highways Committee purchased about 19,500 tons of coal and 800 tons of coke for use at the Greenwich power station, at a cost of about £43,000, during the quarter ended December 31st, 1917.

The Highways Committee has granted an additional war bonus of 5s. a week (making £1), from December, 1917, to the operative staff at Greenwich power station and the tramways sub-stations. The cost is estimated at £2,400 during the current year and £7,100 during 1918-19.

The Highways Committee has settled 1,034 claims against the Council in respect of accidents in connection with the working of the tramways, at a cost of £7,748; 15 actions were brought against the Council: in six a verdict against the Council was given, and £326 and costs had to be paid.

Norwich.—The time for compulsory purchase of lands under the Norwich Electric Tramways Act, 1914, has been extended by a further period of one year.

Sunderland.—RATE RELIEF.—The Tramways Committee has decided to allocate £5,000 towards the relief of the rates. The net profit on the year's working amounted to £12,500.

United States.—The Chicago, Milwaukee and St. Paul Railway, which has already electrified 440 miles of its main line through the Rocky Mountains, has placed contracts for the electrification of 220 miles from Othello to the Pacific Coast ports of Seattle and Tacoma. There will be 17 locomotives and 8 sub-stations. The Westinghouse Electric Co. furnishes 7 locomotives and equipment for 5 sub-stations, while the General Electric Co. has the balance of the contract. The sub-stations are spaced 21 to 35 miles apart, and have either one or two motor-generator sets of 2,000 KW., with space for an additional set in each case. They are 3,000-volt continuous-current machines, having a 2,500-K.V.A., 2,300-volt, 60-cycle motor and two 1,000-KW., 1,500-volt, direct-current generators connected in series. Each set can carry 200 per cent. overload for 5 minutes. Two stations will be supplied with 55,000-volt current, while the others will have 102,000-volt current. The line crosses a mountain range, and has three long gradients of 1 in 45, 1 in 62 and 50 miles of 1 in 100 to 1 in 57. Two of the engines are shunting locomotives of 75 tons weight, each carried on a pair of four-wheel bogies. They have a tractive effort of 22,000 lb. The passenger locomotives will have 12 motors, the Westinghouse engines using the quill type of driving gear, and the General Electric engines having a bipolar gearless drive. These locomotives are required to haul trains of 12 steel carriages, or 960 tons, at 25 miles an hour on the ruling gradient of 1 in 48, and at 60 miles an hour on level line. The contract required the first 10 engines to be completed in four months.—*Engineer.*

TELEGRAPH AND TELEPHONE NOTES.

Egypt.—The purchase of the Egyptian telephone system has been fixed at 755,000 Egyptian pounds (£774,661). The Government has taken over the telephone service as from January 1st, and will pay interest at the rate of 5 per cent. until the completion of the purchase. The Council of Ministers has approved of the transaction.—*The Times.*

India.—During the year 1915-16, the telegraph system increased by 3,128 km. of line to 138,567 km., and by 12,376 km. of wire and cable to 543,729 km. The offices open numbered 8,592, including 5,084 railway offices, and the staff 10,756. The traffic amounted to 18,129,748 telegrams, and the receipts were 22,551,486 fr. The telephone system comprised 287 Government exchanges with 8,115 subscribers, and 13 private exchanges with 10,766 subscribers. There were 19 radio-telegraph stations, nine being on the coast; the latter dealt with 83,719 messages. The accounts, on the whole, showed a surplus of 7,222,603 fr.—*Journal Télégraphique.*

London Telephone Directory.—The January edition of the London Telephone Directory, which is now being delivered to subscribers, has been brought up to date by the inclusion in each entry of the number of the postal district in which the subscribers reside.—*The Times.*

Telegraphs and Telephones in 1917.—In the course of a review of 1917, the *Telegraph and Telephone Journal* states that there was a great extension in the working of telegraph lines on the Baudot system, and a considerable further development in multiplex working is in progress. A system for facilitating the disposal of telegrams by diversion was introduced with excellent results, some 15,000 transmissions a day having been saved by this means. This had the effect of relieving the large central offices where the staff was depleted, and giving more employment to smaller and less busy centres. The experimental abolition of the "office copy" has also had the most satisfactory results, effecting a saving of upwards of 50,000,000 forms and at least a million carbons, together with economies in other directions, besides materially lightening the work of telegraphists. On the telephone side, the opening of the new Central Exchange at Manchester marked the completion of a work of considerable magnitude. The exchange system was extended to some dozen towns and villages during 1917. The year also witnessed a considerable extension of the system of handling telegrams over the telephone. In April, Edinburgh and Glasgow were placed on the direct system of trunk working similar to that in force between Manchester and Liverpool and other places. Close upon 550 members of the telegraph and telephone staff alone (including engineering staff) gave their lives for their country during the year.

Wireless Telephony.—At the Point Judith light, near Newport, R.I., wireless telephone apparatus has been installed, to enable the operators to telephone the name of the light to mariners during fog or thick weather. The warning is given by repeating the words: "Point Judith Light" every five seconds, with a limit of range of about eight miles. After every third repetition the warning: "You are getting closer, keep off," is sent out, with a limit of range of about two miles. The signals are received on the ordinary ships' wireless equipment.—*T. and T. Age.*

According to the *South China Morning Post*, the Communications Department of Japan has developed a method of connecting the ordinary telephone with the wireless telephone, so that a message from a ship at sea may be transmitted through a shore exchange to a subscriber. Credit is given to Messrs. Tonegawa and Torigata for the work. It will be remembered that the same feat was accomplished in the United States in 1915.

According to the *Journal Télégraphique*, the number of wireless stations open at December 31st, 1917, was 6,113, of which 687 were coastal stations and 5,338 on board ship, the remaining 88 being inland.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

ADELAIDE.—February 27th. P.M.G.'s Department. Telephone material. Schedules 479 and 483. See "Official Notices" January 18th

Croydon.—February 18th. Tramways Department. 3, 6, or 12 months' supply of general stores: Tramways Manager, Thorton Heath Depôt.

London.—L.C.C. February 18th. Tramways Department. 4,500 forged steel driving wheel tires, and 3,000 forged steel trailing wheel tires. Manager, L.C.C. Tramways, Belvedere Road, S.E. 1.

Manchester.—February 12th. Tramways Department. General stores, including electric lamps, insulating material, overhead equipment, &c. See "Official Notices" February 1st.

February 13th. Electricity Committee. One 150-H.P. three-phase fan motor and switchgear. Mr. F. E. Huhges, Secretary.

Newport (Mon.).—February 18th. Electricity Department. One 3,000-KW. turbo-alternator and surface condensing plant. See "Official Notices" February 1st.

Salford.—February 11th. Tramways Department. 12 months' supply of general stores. General Manager.

Warrington.—February 26th. Electricity Department. Steam pipework. See "Official Notices" to-day.

CLOSED.

Bexhill-on-Sea.—T.C. 1,000 tons of Shipley peas coal, or Manners' washed peas, for the electricity works: Myers, Rose and Co.

Derby.—T.C. Boiler for the electricity works: Babcock and Wilcox, Ltd., £4,595. Two electric coal wagons: General Vehicle Co., Ltd., £2,810.

Hereford.—T.C. Telpher gas plant, with electric hoist: Herbert Morris & Co., Ltd., £1,884.

London.—L.C.C. Supply of tramway fittings equipment, 1917-18. Additional tenders accepted during the quarter ended December. 31st last:—

Cotton-covered copper wire. Class T.6a:—

London Electric Wire Co., & Smiths, Ltd.—Items 1, 3, and 4, approximate value, £925.
Midland Electric Wire Co., Ltd.—Items 2, 5, and 9, approximate value, £5,740.

Rewinding armatures for tramcars:—

P. R. Jackson & Co.—£476.
Drewer Stevenson & Co.—£224.
British Westinghouse E. & M. Co., Ltd.—£167.
H. Dunn & Son.—£340.
Electrical Repair Co., Ltd.—£360.
Burdette & Co, Ltd.—£315.
Collins Electrical Co., Ltd.—£160.

Field coils for tramcars:—

Manchester Armature Repair Co.
Brush Electrical Engineering Co., Ltd.—(Approximate expenditure, £8,980.)

Swansea.—Electricity Committee. Tender recommended. Turbo-alternator, £15,387: James Howden & Co., Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—(**Dublin Local Section.**)—Friday February 8th. At 8 p.m. At the Royal College of Science, Upper Merrion Street. Ordinary meeting.

(**Students' Section**).—Friday, February 8th. At 7 p.m. At Faraday House, Southampton Row, W.C. Paper on "Magnetos," by Mr. R. W. Cockling.

(**Newcastle Local Section.**)—Monday, February 11th. At 6.45 p.m. At the Mining Institute. Paper on "Telephone Exchange Transfers, and their Organisation," by Mr. F. G. C. Baldwin.

(**Manchester Local Section**).—Tuesday, February 12th. At 7 p.m. At the Engineers' Club. Paper on "Some Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant.

(**Scottish Local Section**).—Tuesday, February 12th. At 7.30 p.m. At 207, Bath Sreet, Glasgow. Visit by the President. Ninth Kelvin Lecture, "Kelvin as a Teacher," by Prof. M. Maclean.

(**Yorkshire Local Section**).—Tuesday, February 12th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Large Batteries for Power Purposes," by Mr. E. C. McKinnon.

Physical Society of London.—Friday, February 8th. At 5 p.m At the Imperial College of Science, South Kensington, S.W. Annual general meeting. Papers on "A Recording Thermometer," by Prof. C. V. Boys, F.R.S., and "The Primary Monochromatic Aberrations of a Centred Optical System," by Mr. S. D. Chalmers.

Royal Institution of Great Britain.—Friday, February 8th. At 5.30 p.m. Lecture on "Science and Ethics," by Prof. E. H. Griffiths, F.R.S.

Saturday, February 16th. At 3 p.m. At Albemarle Street, W. Lecture on "Problems in Atomic Structure," (Lecture I), by Prof. Sir J. J. Thomson.

North of England Institute of Mining and Electrical Engineers.—Saturday, February 9th. At 2 p.m. At Neville Hall, Newcastle-on-Tyne. Ordinary meeting.

Institution of Mining and Mechanical Engineers.—Saturday, February 9th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on Tyne. Ordinary meeting.

Salford Technical and Engineering Association.—Saturday, February 9th. At 7 p.m. At the Royal Technical Institute. Lecture Recital by Mr. J. Crewe, on "The Construction and Tone of the Violin."

Birmingham and District Electric Club.—Saturday, February 9th. At 7 p.m. At the Swan Hotel, New Street. Discussion on "The Decimal System," to be opened by Mr. H. C. James-Carrington.

Society of Engineers.—Monday, February 11th. At 5.30 p.m. At Burlington House, Piccadilly, W. Presidential address by Mr. W. B. Esson, and Presentation of Premiums.

Association of Supervising Electricians.—Tuesday, February 12th. At 7.15 p.m. At St. Bride's Institute, E.C. Paper on "D.C. Motor Troubles," by Mr. E. F. Butler.

Association of Engineers-in-Charge.—Wednesday, February 13th. At 8 p.m. At St Bride's Institute, Bride Lane, E.C. Paper on "The Place of Economics in Transport and Engineering," by Mr. W. T. Stevenson.

Royal Society of Arts.—Wednesday, February 13th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Relations between Capital and Labour—Reasonable Hours, Co-partnership and Efficiency," by Lord Leverhulme.

Faraday Society.—(Manchester meeting.) Thursday, February 14th. At 7 p.m. At the Municipal School of Technology, Whitworth Street. Discussion on "Electric Furnaces."

Electro-Harmonic Society.—Friday, February 15th. At 6.15 p.m. At the Holborn Restaurant, (Venetian Chamber). Concert (Ladies' Night).

Institution of Mechanical Engineers.—Friday, February 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, February 16th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Steam Turbines as Applied to Colliery Work," by Mr. P. J. Pliven.

NOTES.

Training Disabled Men.—At a meeting, at Birmingham, of the West Midland Joint Disablement Committee, Alderman James announced that there was a probability of establishing in that city in the near future a large school for training disabled men in electrical engineering. The proposals were for the instruction of at least 100 men.

Institution and Lecture Notes.—Royal Institution.—At the general meeting of the members on the 4th inst., the managers reported that Dr. Mond, under the conveyance and deed of trust of the Davy Faraday Research Laboratory, covenanted to pay to the Royal Institution before the year 1926 the sum of £62,000 as endowment fund. The trustees had anticipated the obligation by eight years, and had transferred the sum of £66,500 in 5 per cent. war stock to the trustees, nominated by the managers, of the Davy Faraday Research Laboratory Endowment Fund. This would add materially to the income available for the purpose of promoting and maintaining the efficiency of the laboratory in the advancement of original research in chemical and physical science.

Bradford Engineering Society.—Last week Mr. Edward Shotton, of the Jowett Motor Manufacturing Co., addressed the Society on the subject of electric vehicles. The lecturer referred to the early history of the electric vehicle, and described modern types; he regretted that many owners did not keep records of running costs, but data available showed that these were generally such as would make the petrol or steam vehicle owner envious. The lecturer also referred to electric industrial trucks for factory use, and mentioned as an example their use at Manningham Mills.

Association of Mining Electrical Engineers.—A meeting of the Yorkshire Branch was held at Wakefield, on January 26th, and discussed a paper by Mr. C. A. Nelson, of the North of England Branch, strongly advocating the application of electrical power for all colliery purposes.

Economise Fuel.—In view of the necessity of reducing the consumption of coal, and the labour and transport required to handle it, Mr. Guy Calthrop, Controller of Coal Mines, desires to draw the attention of all consumers of gas and electricity throughout the country, to the need of the greatest possible economy in their use. These commodities are so easily obtainable, and are, comparatively speaking, so cheap, that few people appreciate the fact that, in the aggregate, many millions of tons of coal are required annually to produce them. There is undoubtedly a very great deal of unnecessary use, and consequent waste, and, if enforced economy is to be avoided, a material reduction must be effected by voluntary action.

He appeals, therefore, to all classes of consumers to take this matter in hand for themselves, and to see that every gas burner and electric switch over which they have control is used as sparingly as circumstances will allow. The need for this economy is accentuated where large cities and towns are remote from coal-fields, as is the case with London and other cities and towns in the South.

Appointments Vacant.—Mechanical engineer (65s. +), shift engineer (63s.), Borough of Leigh (Lancs.) Electricity Department; commercial assistant (£220), for the Stoke-on-Trent Corporation Electricity Department; shift engineer (50s. +), for the Borough of Weymouth Electricity Works; meter tester and repairer (54s.), for the Borough of Colchester Electricity Department. See our advertisement pages to-day.

Novel Electric Ship Proposal.—The Liverpool *Journal of Commerce* recently outlined a proposal by Mr. H. de M. Snell for ship construction on somewhat novel lines. The suggestion is to have one set of detachable power producing machinery for three or more hulls, which would each be equipped with propellers and electric driving motors only, arranged for coupling by cables to the power plant. The power plant is apparently housed in a detachable and floatable poop, which can be continuously employed in propelling one or other of the hulls, and can, in times of stress, be separated from the hull. It is suggested that existing hulls in which the machinery is worn out can be reconstructed on the new system and be further used. No details of the arrangement proposed are, however, given in our contemporary.

Educational.—Examinations in Science and Technology. The Board of Education has decided to discontinue the general examinations in Science and Technology altogether after 1918. The higher general examinations will be held in that year, with the exceptions specified in Circular 970. The regulations and syllabuses which governed the examinations held in 1915 will remain in force for 1918, so far as they are still applicable.

Association of Teachers in Technical Institutions.—A meeting of teachers engaged in the Technical Institutes, Junior Technical Schools, and Trade Schools of London and neighbourhood was held at the Polytechnic, Regent Street, W., on Saturday last, to consider the question of salaries. There was a large attendance, and in the discussion emphasis was laid on the fact that the salaries paid in institutions of the above-named types compare very unfavourably with those paid in industry and in secondary schools. A resolution declaring that the present rates of salaries paid to both day and evening teachers in technical institutions are totally inadequate, and urging educational authorities to take immediate steps to establish satisfactory scales of salaries for all teachers, was carried unanimously. A further resolution requesting the Government to allocate special grants, similar to those given in the case of secondary and elementary schools, for improving the salaries of teachers in technical schools and institutes was also unanimously adopted. It was agreed that the London Branch of the Association should request the County Councils of London and the Home Counties to receive a deputation to place before them the views of the meeting.

American Engineers and the Forces.—According to the *Electrical Review* (Chicago), the U.S. Engineering Council passed the following resolution in December:—"The Engineering Council, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, recognising the serious responsibility of the engineer for the successful prosecution of the war in the many branches of the national service where highly-trained engineers are required, urges the importance, as a war measure, of maintaining unimpaired the engineering strength of the nation, for the successful prosecution of military operations and for the support of sustaining industries. Since schools of engineering are the principal sources from which trained engineers may be drawn, the Engineering Council urges that in the administration of the selective draft the Government should maintain these schools in full operation, and should take such steps as will enable qualified engineering students to continue their studies to graduation, if possible, and, in any event, until necessity demands their call for active service. This recommendation is made for the sole purpose of ensuring the continuous supply of trained engineers for the future service of the nation."

A Government Trade Mission.—It is announced that Sir H. Llewellyn Smith, Permanent Secretary to the Board of Trade, has undertaken a special mission on behalf of the Government. He is accompanied by Mr. H. Fountain, of the Commercial Relation and Treaties Department, and by Mr. Walter Carter (private secretary), and will be absent from the office for some weeks.

Callender's Hospital and Distress Fund.—A general meeting of this fund was held at the Belvedere works of Messrs. Callender's Cable and Construction Co., Ltd., on February 4th, when the Committee's statement for the year ended December, 1917, was adopted. The report, which is the fifteenth annual statement since the fund was started, shows that the total sum received by penny-weekly subscriptions in the fourth year of war is the highest on record—namely, £321; donations (including £50 from the company and personal gifts from the directors, &c.) added up to £85. Gratuities paid out to members were £79, grants to hospitals, &c., £297. The balance at bank and in hand is £109. The grants to hospitals and institutions at which members received benefit were larger than in any previous year. A large number of hospital letters were issued, and other assistance took the form of special home nursing, surgical appliances, spectacles, convalescent home letters, and financial help.

Tar Oils.—The Minister of Munitions announces in the *London Gazette* of February 1st that the Order of October 23rd, 1917, controlling tar oils is cancelled, and he now takes possession of all tar oil in the United Kingdom, and all dealings in tar oils without a licence are forbidden, except where the quantity purchased does not exceed five gallons per month; but persons who have applied for licences may continue to take delivery of tar oils under existing contracts for fuel to a total amount not exceeding one month's average deliveries. The contract note is to specify the grade and price of the oil with all extra charges, and the price must not exceed a scale given in a schedule, except in the case of contracts entered into prior to July 13th, 1917. Holders of stock must furnish to the Controller of Explosives Supply, Storey's Gate, S.W. 1, particulars of their transactions as directed by him. The term "tar oil" includes light oil, sharp oil, creosote oil, green oil, and anthracene oil, and any other oil produced or containing oil derived from tar, with the exception of crude benzol, naphtha, &c. The schedule gives specifications of the various oils, and the prices, ranging from 90s. 6d. per ton for Diesel-engine oil down to 41s. 6d. for a mixture of creosote oil 25 per cent. and pitch 75 per cent., f.o.r. or f.o.b.

Applications for licences should be addressed to the Controller, Mineral Oil Production Department, Ministry of Munitions, 8, Northumberland Avenue, W.C. 2.

Screw Gauges.—Before the war, the accurate cutting and gauging of screw threads had attracted a great deal of attention, but the progress then being made was a standstill compared with that which has been accomplished during the war, and in this important work the National Physical Laboratory has naturally played a leading part. An enlarged issue of the "Notes on Screw Gauges" prepared by the staff of the gauge-testing department was recently published, which in itself demonstrates the thoroughness and efficiency with which this very difficult subject has been tackled by the authors, and the high degree of perfection which has been attained; the complexity of the matter is well illustrated by the fact that "the Whitworth thread has seven elements, error on any one of which may be sufficient to cause a gauge to reject work which ought to pass, or *vice versa*." These elements are discussed in detail in all their bearings, and the approved methods of making the necessary measurements are explained, with full descriptions of the apparatus employed.

The correct methods of cutting accurate screw threads are also described, and the latest devices for carrying out optical measurements of screw gauges are fully explained, including the projection method, which has been brought to its present pitch of refinement, we believe, entirely at the N.P.L. Even now the elements of ring screw gauges cannot readily be measured in the workshop, and these gauges are generally tested between limits by plug gauges. The brochure is indispensable to anyone concerned with the accurate cutting of screw threads.

Limiting Alternator Short-Circuit Currents.—Under this title in the *Electrical World*, Vol. 70, No. 10, Mr. Ralph Bonn discusses the actions and reactions which take place when an alternator is short-circuited, and shows theoretically, as well as with oscillograms, that the heavy armature reaction induces an electromotive force in the field winding which greatly increases the field current, and thus prolongs the duration of the heavy armature current. In the case of alternators with non-salient poles, very little can be done to reduce the short-circuit current except to introduce series reactance in the armature circuit. With salient poles, however, the course of events can be modified by introducing resistance and inductance into the field circuit. Added resistance shortens the period by dissipating the field energy more quickly, without materially reducing the magnitude of the short-circuit current. Inductance, on the other hand, introduced externally, restricts the increase in the field current, and thus reduces the initial value of the armature short-circuit current. While the experiments were carried out on a laboratory scale only, there may be cases, says the author, where the introduction of inductance into the field circuit to limit the short-circuit current would be good engineering.

The Case for 110-Volt Lamps.—According to J. R. Colville (*Electrical World*), in the U.S.A., glow lamps rated at 110 to 125 volts represent about 85 per cent. of the output of tungsten lamps (vacuum and gas-filled types), excluding miniature lamps. Lamps of the 220 to 250-volt class represent only about 7 per cent. of the factory output, and even this figure would be reduced were it generally realised how great is the total advantage of low-voltage lamps in point of low price, high efficiency, long life, and cheaper fittings-installation. The difference in cost of 110-125-volt and 220-250-volt lamps, based on the contract schedule in force last June, ranges from 2d. per 25-watt vacuum-tungsten lamp bought under a £2,000 contract to 5s. 10d. per 1,000-watt gas-filled lamp bought at list price. Subject to a few per cent. variation, according to wattage, 230-volt lamps cost 20 to 25 per cent. more than 115-volt lamps, and yield only 90 per cent. as much light for equal wattage. The low-voltage type offers fewer manufacturing difficulties, and is made in so much greater quantities, that it is a more highly standardised product, and one in which the latest improvements are more easily incorporated. In a new lighting installation the use of 115-volt lamps, instead of 230-volt units, often saves enough in the cost of outlets, fittings, and accessories to pay for a balancer coil, motor-generator, or other voltage-halving equipment. The annual saving in lamp renewals and energy is then clear profit. In any but the smallest installations it is better policy to use a voltage-halving equipment and 3-wire distribution, rather than run pairs of low-voltage lamps in simple series connection.

Domestic Electrical Appliances in the U.S.A.—The Society for Electrical Development has recently made a rough census of domestic electrical appliances sold by 100 leading manufacturers in the U.S.A. These, it appears, have sold 7,194,792 pieces of apparatus, including over 3,000,000 irons, 1,880,000 fans, 673,000 vacuum cleaners, 241,000 washing machines, 239,000 disk stoves, 122,000 grills, and 114,000 percolators, the balance comprising dish washers, heating pads, teapots, heaters, radiators, ironing machines, chafing dishes, ranges, vibrators, water heaters, griddles, &c.

Standard Electric Lighting Sets for U.S.A. Farm Use.—In view of the increasing trade that is being done in the United States in electric lighting sets for farm use, and in order to ensure that the majority of manufacturers of such sets shall fix ratings on the same basis, the American Society of Agricultural Engineers has recently recommended certain standard ratings and specifications. The pamphlet issued by the Society recommends that 30 volts be adopted as the pressure for low-voltage lighting plants, and that with such sets 16 lead-sulphuric acid cells in series, or 24 Edison cells, be adopted as standard. It also recommends that the manufacturers of farm lighting sets should agree on a standard lamp of a certain voltage range, to be known as the farm service lamp.

Electro-Harmonic Society.—The next concert (Ladies' Night) will be held at the Holborn Restaurant in the Venetian Chamber on Friday, February 15th, commencing at 6.15 p.m. The artistes will be:—Miss Violet Oppenshaw, contralto; Mr. David Ellis, tenor; Mr. Edgar Coyle, baritone; Miss Adelina Leon, violoncello; Mr. Lewis Sydney, humourist at piano; Mr. George Bolton, entertainer at piano; Prof. Anders, conjuror and sleight-of-hand; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist. Chairman: Mr. Llewellyn B. Atkinson.

The A.E.S.E. in Sheffield and District.—A large and representative gathering of engineers met on Wednesday evening, January 30th, at Atkinson's Café, Sheffield, to form a branch of the A.E.S.E. A deputation from Manchester were invited to attend, and included Messrs. Lunn, Pausey, and Thomas, the last-named being secretary for the Manchester branch. Mr. Fedden, general manager and engineer of the Sheffield electric supply department, who took the chair, opened the meeting with some explanatory remarks with reference to the standing of the present-day power engineer and his future position when the recommendations of the Whitley report are carried into effect. Messrs. Lunn and Pausey spoke on the Association of Engineers and the increase of efficiency created by the interchange of ideas that would accrue through being members of the Association. Mr. Thomas gave a general review of the policy of the Association. A resolution was put by the chairman to form a Local Section, and this was carried unanimously. Representatives came from Barnsley, Hull, Leeds, Mexborough, and Rotherham. Apologies were received from several prominent engineers in the district, who were unable to attend.

The Whitley Report.—The Industrial Reconstruction Council has issued a small pamphlet entitled "Trade Parliaments," in which explanatory information respecting the Whitley Report appears. The urgency of the different trades each taking steps to carry into effect the recommendations set forth in the Report is emphasised, and some suggestions are made as to their application. We recommend our readers to apply to the Secretary of the Council, 8, Bouverie Street, E.C. 4, for a copy of the pamphlet.

Keeping Down the Peak Load.—Under the strenuous conditions imposed upon electricity supply undertakings by the war, the importance of keeping down the peak load has greatly increased, and efforts have been made in some cases to induce large consumers to vary their hours of starting and stopping work, lunch times, &c., so as to improve the diversity factor and keep the load off the peak, with fair success. In the *Electrical World*, Vol. 20, No. 22, some particulars are given of the working of this policy in a district where a number of new industries connected with the emergency shipbuilding programme of the U.S.A. Government have been established, throwing unprecedented loads on the power station. While the tramway and private lighting loads could not be modified, all power users taking over 50 H.P. were interviewed, and only two out of the first 266 that were visited were unable to co-operate with the supply undertaking in this way; by arranging an earlier closing hour with some 24 consumers, 2,600 KW. was taken off the peak. Where large numbers of men were employed, instead of all the employés leaving the works at the same time, arrangements were made for them to leave in batches at half-hour intervals, thus smoothing out both the power and tramway curves, and diminishing the congestion on the tramways. This policy has to be applied with discrimination, lest, for example, the release of a large number of workers just before the peak should produce a greater increase in the tramway load than the amount of the power load cut off; but it is evident that when carefully carried out the plan is well worth adoption where shortage of plant renders the height of the peak a serious consideration.

Generating Steam with Electrical Energy.—The Swiss Society of Steam Boiler Owners has carried out tests on the commercial possibilities of generating steam with electricity derived from water power. A small boiler was used with 38 steel tubes, in 34 of which were placed heating coils. An evaporation of 2½ lb. of water per sq. ft. of heating surface was obtained, and the efficiency was 90 to 91 per cent. To compete with coal in Switzerland, at 44s. per ton, the cost of energy would have to be not more than ·08d. per unit.

Owing to the scarcity of coal, which now costs over £3 a ton and is likely to reach £4, the working of the Swiss railways is costly and difficult, and the feasibility of using electric heating on steam locomotives is being seriously considered. While the complete electrification of the railways cannot be accomplished at present, the supply of electricity to the locomotives would present less difficulty, and the cost of energy from water power would be only 0·15d. per unit, which would be comparable with the cost of coal. In view of the possibility that the supply of coal from Germany may be completely stopped, the subject is of some importance to the railways, which would have no alternative in such an emergency.

Plant for Disposal.—Barrow-in-Furness electricity department is inviting offers for one 500-KW. D.C. steam generator and one switchboard panel. Full particulars are given in our advertisement columns to-day.

Municipal Electric Vehicle Costs.—Some tabulated data have recently been published by the *Surveyor* on the subject of costs of municipal electrical vehicle working, which is based on information supplied to the Weymouth Corporation. The following is of interest:—South Shields (two Edisons), 2s. 9d. per t.m. electric, 4s. 5½d. per t.m. horse, six horses replaced; Ipswich (one Orwell), 1s. 1½d. per t.m. electric, 1s. 9d. to 2s. per t.m. horse, three horses replaced; Leyton (one Edison), probably a saving of 2d. per mile by electric, 2½ horses replaced; Dover (six Edisons), 1s. 8d. per t.m. electric, 2s. 9½d. per t.m. horse; Ilford (one Edison), 9½d. per t.m. electric, 1s. 2d. per t.m. (by contract) horse, four horses replaced. It may be noted that the wages paid, and number of helpers, vary very much with the locality. General haulage is carried out at Ipswich and coal haulage at Ilford, otherwise the vehicles are employed in refuse removal. The vehicles run from 2 to 4 tons capacity, and, with one exception, are fitted with power tipping gear. The price of electricity for battery charging varies from 1d. to 1¾d. per unit. With one exception the various authorities record their view that the electric vehicle is more satisfactory than the horse for short journeys. At Ipswich it is considered that the horse is more economical for journeys of 2½ to 3 miles.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending February 16th, 1918, by Lieut.-Colonel C. B. Clay V.D., Commanding.

Officer for the Week.—Lieut. C. E. Campbell.

Next for Duty.—Lieut. W. J. A. Watkins.

Monday, February 11th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 12th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, February 13th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 14th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, February 15th.—Musketry, 5.30—8.

Saturday, February 16th.—Knotting, &c., for the whole corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Special Notices.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Notes from Spain.—Our special contributor in Spain sends the following:—Madrid's lighting problem through coal shortage has been made more difficult by the specially dry winter, the output from the hydro-electric plants falling very much below normal, one fall (Bolarque) being practically useless. Such low water in January has not been known for many years past. The rainstorms at the end of the month have now improved matters. According to the Commission of Supply, 600 tons of coal are used daily in the production of electricity for Madrid. The Commission suggests that during the absence of public street lighting, house owners should fix small lamps outside their houses, and has promised a reduction of rates to house owners doing this.

The price of gas in Seville has been raised to ·55 peseta per cb. metre—about 12s. 3d. per 1,000 ft.

The Spanish Government has ordered that all Spanish boats of more than 500 tons must be fitted with complete wireless installations by the end of July, 1918.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Manchester Electricity Supply Committee recommends the following increases of salary in the electricity department:—Mr. A. E. Mackenzie, deputy chief engineer, from £750 to £850 per annum; Mr. F. E. Hughes, secretary, from £500 to £550; Mr. H. C. Lamb, resident engineer, Stuart Street Station, from £500 to £600; Mr. W. E. Foden, accountant, £450, to be appointed financial superintendent and statistical officer at £550 per annum; Mr. E. Bolton, sub-stations engineer, from £450 to £500. The Tramways Committee recommends that the salaries of tramway officers be increased as follows:—Mr. Jas. Wood, financial superintendent and assistant manager, from £600 to £750 per annum by three annual increments of £50 each; Mr. J. T. Oakes, traffic superintendent, from £500 to £600 per annum by two annual increments of £50; Mr. F. A. Mitcheson, accountant, from £400 to £550 per annum, by three annual increments of £50; Mr. G. R. Blackburn, from £400 to £500 per annum by two annual increments of £50 each; Mr. D. G. Mallalieu, permanent way superintendent, from £350 to £400 per annum.

The Sydney (N.S.W.) City Council has been recommended to vote £250 to Mr. S. Y. Maling, deputy general manager of the Corporation electricity undertaking, in recognition of his services as acting general manager during the absence of Mr. H. S. Forbes Mackay (general manager) in America, and for the satisfactory discharge of the heavy responsibilities devolving upon him during the period of the recent strike.

The Aylesbury T.C. has appointed Mr. Bundock as works manager at the electricity works.

The Gloucester T.C. has increased the salary of the electrical engineer and general manager of the light railways (Mr. Corson) from £500 to £600 a year.

The Loughborough Corporation Electricity Committee has granted Mr. R. B. Leach, the borough electrical engineer, an advance of £50 per annum in salary, and expressed high appreciation of his services.

General.—Mr. J. M. Jackson, secretary of the Record Electrical Co., Ltd., has been granted leave of absence to join an officers' cadet unit of the R.F.C.

The *Times* announces that Mr John Hodge M.P., has appointed

SIR C. H. KENDERDINE, K.B.E., a Director of Artificial Limb Supplies in the Ministry of Pensions.

On January 26th, at Holy Trinity Church, Brompton, the marriage was solemnised of MR. RALPH H. CRIDGE, B.Sc. (Eng.), Lond., of Electro-Metals, Ltd., and Miss Lilian A. Storr, B.Sc. (Hons.), Lond., late senior mathematics mistress at the Girls' High School, Burnley.

On February 7th, at Brompton Oratory, Kensington, MR. ARTHUR JOHN GREENLY was married to Caro Fantini, third daughter of Mrs. E. M. Fantini, of Putney, S.W.

Roll of Honour.—CORPL. H. J. H. CLARK (23), Royal Warwickshire Regiment, formerly on the staff of Messrs. Vaughton, electricians, of Birmingham, has been awarded the Military Medal. He held "a bombing step on the right flank of an isolated company for 22 hours, inflicting numerous casualties on the enemy."

PRIVATE JAMES BRIXEY, Rifle Brigade, an employé of Messrs. A. P. Lundberg & Sons, has been awarded the Military Medal for devotion to duty in holding the lines of communication under shell fire.

LIEUT. D. S. BADDELEY, Motor Transport Corps, who has been in France for over two years, has been decorated with the Order of the Crown of Belgium and the Croix de Guerre Belge. Mr. Baddeley is representative for Messrs. Crompton & Co., Ltd., for Scotland and the North of Ireland.

SERGEANT W. WILLIS, London Regiment, has been awarded the Military Medal for holding an advanced trench in spite of repeated counter-attacks, the position being held for 36 hours, although Sergeant Willis was wounded in the back. He was at one time in the employ of Burnley Corporation tramways department, afterwards taking up a position with the Torquay Corporation tramways.

The death in action is reported of LANCE-SERGEANT ROBERT G. CASTOR, L.N.L. Regiment, who was employed by Messrs. Dick, Kerr & Co., of Preston.

ARTHUR THOMAS, who joined the Army whilst an electrician at the Port Talbot steel works, has died in Mesopotamia from double pneumonia.

WIRELESS OPERATOR A. C. PEGGS, of Leigh, Southend-on-Sea, has been drowned through the sinking of the vessel on which he was the operator.

PRIVATE LEWIS PARSLOW, South Wales Borderers, who was for 17 years with Messrs. E. T. Mackrill & Sons, electrical engineers, of Aylesbury, has died from pneumonia whilst on active service.

The employés of the Leeds tramway department serving in His Majesty's Forces have in all been awarded 13 distinctions, consisting of one Distinguished Service Order, four Distinguished Conduct Medals, and eight Military Medals.

Twenty-five per cent. of the employés of Messrs. A. Reyrolle and Co., Ltd., joined up at the commencement of the war. Ten of these have been the recipients of the following honours and promotions:—Honours: James Taylor, Quartermaster-Sergeant, Military Cross; G. Huskisson, Lance-Corporal, Military Medal; J. Kellett, Reg. Sergeant Major, Meritorious Service Medal; R. W. Laine, Sergeant, Mentioned in Dispatches. Promotions from the Ranks:—Five others have been made Captains and one a Lieutenant.

PRIVATE G. HYHAMS (London Regiment), formerly in the Special Sales Department of the India-Rubber Co., Cannon Street, E.C., died of wounds in Egypt.

PRIVATE H. FENNELL (Middlesex Regiment), who was in the Experimental Department of the India-Rubber Co., Silvertown, was wounded recently.

Obituary.—The death has occurred of MR. WM. HENRY CLARKE, who had for 13 years held a position at the Newport (Mon.) Corporation electricity works. He was 32 years of age, and had invented an anti-aircraft shell which had passed the Inventions and Research Committee.

NEW COMPANIES REGISTERED.

Cass's Motor Mart, Ltd. (149,466).—Private company. Registered January 29th. Capital, £2,000 in £1 shares. To take over the business carried on at 5, Warren Street, St. Pancras, as Cass's Motor Mart, and to carry on the business of motor and electrical engineers, agents, and dealers, &c. Agreement with L. E. Cass & E. R. Cass. The subscribers (each with one share) are:—E. R. Cass, 414, Archway Road, N. 6, engineer; L. E. Cass, 287, Archway Road, N. 6, engineer. The first directors are:—L. J. Cass (permanent director and chairman), L. E. Cass, and E. R. Cass. Registered office: 5, Warren Street, St. Pancras, N.W.

Accumulators (Birmingham), Ltd. (149,465).—Private company. Registered January 28th. Capital, £5,000 in £1 shares. Manufacturers of, and wholesale and retail dealers in, accumulators for lighting and starting motors, motor cycles and cars, aeroplanes, airships, engines of all kinds, house lighting, and other electrical plants, &c. The subscribers (each with one share) are:—W. H. M. Burgess, 40, Glasshouse Street, W., merchant; H. J. Prockter, The Gables, Lingfield, Surrey, architect. Permanent directors: W. H. M. Burgess and H. J. Prockter. Remuneration, £200 each per annum, free of income-tax. Registered office: 36-40, Glasshouse Street, Piccadilly Circus, W. 1.

Blackhall Engineering Co., Ltd. (9,993).—Private company. Registered in Edinburgh on January 24th. Capital, £12,000 in 11,775 ord. shares of £1 each and 9,000 def. shares of 6d. each. To purchase an option and to adopt and carry into effect an agreement between J. H. Ballantyne, J. W. [illegible], and J. L. Mackie, and to carry on the business of [illegible] and general engineers, &c. The subscribers (each with one share) are: [illegible] Ross, 4, [illegible] Drive, [illegible]; Robt. N. [illegible], 28, [illegible] Street, Glasgow. The first directors are J. H. Ballantyne and J. W. [illegible]. Solicitor: J. L. Mackie, 12, St. Vincent Street, Glasgow.

Mica & Micanite Supplies, Ltd. (149,471).—Private company. Registered January 28th. Capital, £1,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are:—R. Keedwell, 183, Croydon Road, Anerley, S.E. 20, clerk; G. E. T. Stebbing, 33, Rosebery Road, S.W. 2, law clerk. The first directors are to be appointed by the subscribers. Registered office: 3, Great Winchester Street, E.C.

Fortluminium, Ltd. (149,446).—Private company. Registered January 24th. Capital, £10,000 in 9,500 ord. shares of £1 each and 10,000 deferred shares of 1s. each, to establish and develop the aluminium alloy known as "forfluminium." The subscribers (each with one deferred share) are:—J. T. Lane, Heatherdale, Woodford, engineer; F. R. Rand, 38, Victoria Street, S.W. 1, railway contractor; C. Vautin, Salisbury House, London Wall, E.C. 2, metallurgical engineer. The first directors are:—F. R. Rand and J. T. Lane. Qualification, 2,500 deferred shares. Remuneration as fixed by the company. Solicitor: J. B. Willis, 59, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Blackpool, St. Annes & Lytham Tramways Co., Ltd.—Memorandum of satisfaction in full on October 30th, 1917, of debentures dated 1905-13, securing £20,000 has been filed.

Elieson Electric Traction Co., Ltd.—Debenture dated January 18th, 1918, to secure £225 and further advances up to a total of £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. P. Elieson, 24, St. Mary Abbotts Terrace, Kensington, W.

Birmingham District Power & Traction Co., Ltd.—Trust deed dated January 7th, 1918, to secure £40,000 second debenture stock (with power to issue further stock ranking *pari passu* to an amount not exceeding £200,000), charged on the company's present and future assets (subject to prior debenture stock, of which £454,890 has been issued). Holders: Electrical & Industrial Investment Co., Ltd., Kingsway, W.C.

Bastian Electric Co., Ltd.—Particulars of £2,000 debentures created September 3rd, and secured by trust deed dated November 12th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. None of the debentures have been issued at present. Property charged: Leasehold hereditaments comprising first, second, and third floors of 185, Wardour Street, W., and the company's other assets, present and future, including uncalled capital. Trustees: R. H. Forman and R. G. Warner.

Amazon Telegraph Co., Ltd. (44,532).—Capital, £250,000 in £10 shares. Return dated December 11th, 1917. All shares taken up; £250,000 paid. Mortgages and charges: £245,100.

Chilean Electric Tramway & Light Co., Ltd. (57,203).—Capital, £1,150,000 in 500,000 ord. and 650,000 pref. shares of £1 each. Return dated January 11th, 1918. All shares taken up; £650,000 paid on the pref.; £500,000 credited as paid on the ord. Mortgages and charges: £308,000.

Burmah Electric Tramways & Lighting Co., Ltd. (75,090).—Capital, £200,000 in 20,000 ord. and 20,000 pref. shares of £5 each. Return dated January 2nd, 1918. All shares taken up; £100,000 paid on the pref; £100,000 considered as paid on the ord. Mortgages and charges: Nil.

Caerphilly Electric Supply Co., Ltd. (139,086).—Capital, £6,000 in 400 cum. pref. shares of £5 each, and 1,500 pref. ord. and 2,500 ord. shares of £1 each. Return dated December 31st, 1917. 100 ord. shares taken up, subject to payment wholly in cash, but nothing called up thereon. Mortgages and charges: Nil. (Owing to war, the company has not commenced trading, and therefore no call has been made on the directors in respect of their qualification shares.)

Builers, Ltd. (62,020).—Capital, £400,000 in 20,000 ord. and 20,000 pref. shares of £10 each. Return dated December 19th, 1917. 15,000 ord. and 15,000 pref. shares taken up; £150,070 paid on seven ord. and 15,000 pref.; £149,930 credited as paid on 14,993 ord. Mortgages and charges: Nil.

Robert W. Blackwell & Co., Ltd. (63,446).—Capital, £50,000 in £1 shares. Return dated January 14th, 1917. All shares taken up. £18,338 paid on 18,338 shares; £31,662 considered as paid on the remainder. Mortgages and charges: Nil.

CITY NOTES.

Dublin United Tramways Co., Ltd. The report shows the amount available for division at £96,226. The interim dividend in August absorbed £23,400, leaving £72,836. From this a preference dividend of 6 per cent. for the half-year, and a final ordinary dividend of 5 per cent. are recommended. £15,000 is set aside for renewal of rails, £7,000 is added to general reserve, and £11,500 is written off investments, bringing them approximately to their present market value. £13,461 is to be carried forward. The total receipts from passenger traffic were £353,839, against £319,612 in the previous year; the passengers carried were 66,624,326, against 60,448,121, and the mileage run was 7,732,897, compared with 7,372,606.

The annual meeting was held in Dublin on Tuesday. Mr. WM. M. MURPHY, who presided, referred to the re-issue of £39,400 debenture bonds, and to the fact that stockholders were being given the preference in subscribing for them. They were sometimes told by public men how much better the municipality could manage those tramways than the company did, and how much more profit they could make for the ratepayers than the company paid as wayleaves and for upkeep of streets. He was inclined to think, however, that the citizens knew at least that the tramways would be no burthen on the rates while they owned and worked them. Except for the increase in traffic they would have had a poor showing for the past year. He found that, while the gross receipts had increased since 1912 by £51,100, the working expenses in the same period had increased by £78,503—in other words, the net profits were £25,397 less in 1917 than in 1912. This was not good enough. The dividend of 4½ per cent. on the whole year, reduced from 6 per cent. which they used to pay, was not an adequate return to those who provided the money to establish the undertaking. The inadequacy of the profits was more apparent when it was remembered that the various local authorities had the option of acquiring by purchase the tramways in their respective districts within less than 20 years; and it was necessary they should not only get a fair interest, but that they should build up a reserve faster than they had been doing to meet any deficiency in the purchase price. They had hitherto relied on the increase of traffic to meet the increased expenses, but an increase of fares seemed to him the only way in which they could retrieve their position in face of the ever-growing working costs. There were certain fares fixed by statutory authority, but there were others which could be raised, especially on overlapping stages. The cost of electrical operation had increased by £5,376, of which £4,511 was due to the advance in coal price and to coal freights. Unlike British tramway managers, they had been able to get men for all their traffic requirements. With the addition of £15,000 to the reserve for rail renewals, they would have over £75,000 in hand to start with when they next got a supply of rails. He mentioned, in conclusion, the successful carrying through during the year of the change of capital from shares into stock, the advantages of which, he said, were obvious. With regard to a discussion at the Dublin Corporation on the company supplying electricity for power for Admiralty work at Alexandra Dock, Mr. Murphy said the fact was they did not wish to give the supply, but the correspondence showed that the Government authorities believed the Corporation could not give it, and issued a Realm Act Order to the Tramways Co. to do so.

Paris Supply Companies. The report of the *Société l'Eclairage Electrique* for 1916-17 states that the growing requirements for the national defence induced the company further to develop the production of war material. At the request of the Ministry for War new manufactures were undertaken, and the works, particularly those at Lyons, assumed considerable importance. On the other hand, large extensions were made at the works in the Rue Lecourbe, the Avenue de Choisy, and the Rue Bolivar and Jarville. The company also participated in the reorganisation of the manufacture of porcelain at the works of Sainte Foy l'Argentière, in order to ensure the delivery of materials which were procured from enemy countries before the war. A considerable share was also taken in the capital of the Société des Applications Industrielles, it being regarded of great interest to become connected with an electrical trust for the development of activity after the war. The accounts show net profits of £190,000, as compared with £146,000 in 1915-16. After placing £99,000 to the legal and special reserve funds, the balance has permitted of the payment of a dividend of 12s. per share, this contrasting with 10s. in the previous year.

The Société d'Electricité de Paris, which owns the large station at Saint Denis, reports that the use of electrical energy in 1916-17 for motive-power purposes expanded beyond all prevision, although the financial results were far from corresponding with this progress. The supply branch was relatively at a disadvantage. Everybody applied to it, and sales increased, but, as the prices paid by consumers were limited by long-term contracts or by specifications, they did not compensate for the formidable rise in the cost of raw materials. The uncertain quality of the coal, and the almost complete lack of finished manufactures for repair work caused the machinery to be submitted to severe trials. It was advisable to renew the machines which were beginning to get obsolete, in order to reduce the consumption of coal. Such renewal was projected before the war, when the price of coal was 16s. to £1 per ton, and it was all the more desirable now, when coal was about quintupled in price. It was impossible, however, to obtain large sets within a convenient period, and the company was compelled to postpone most of the renewal programme owing to the enormous prices demanded by engineering firms, the difficulty of procuring metal manufactures, and the scarcity of labour. Nevertheless, it was none the less necessary to put to reserve the sums which the replacement would absorb, and which would be greater than had been foreseen years ago, when the renewal fund was established, as pre-war prices could not be expected to be seen again for several years to come. It was, therefore, prudent to strengthen the renewal fund, and thus permit of the installation at a fitting opportunity of the most modern types of boilers and turbo-alternators, and therefore enable the great Saint Denis works to maintain its position. The total sales amounted to 154,630,000 KW.-hours, as compared with 116,824,000 KW.-hours in 1915-16, and 145,350,000 KW.-hours in 1913-14, which latter was the previous year's maximum since the starting of supply in 1905-06. After providing for the interest on the loan debt, and placing £20,000 to the renewal fund, the accounts show net profits of £102,000 on an ordinary share capital of £1,000,000, which sum has allowed of the payment of a dividend of 8 per cent., being the same rate as in the preceding year. The renewal fund, with the present allocation, has now reached a total of £320,000.

The directors of the *Compagnie d'Electricité de l'Est Parisien (Est Lumière)*, reporting on the year 1916-17, state that the company suffered from the inadequacy and excessive wear and tear of the plant, the difficulty of obtaining machinery and raw materials, and the dearness of the latter, particularly coal. The development projected before the war had been delayed, and although the assistance of adjoining stations had been obtained, the supplies of energy received from them were far from being of the regular character which had been hoped for. New boilers had been ordered capable of furnishing 20,000 kilogrammes of steam per hour at a cost of £32,000, and these would probably be put into operation in the spring. It was now intended to order a large turbine and further boilers for an output of 30,000 kilos. of steam per hour. The number of consumers, both for light and power, experienced a further increase, and amounted together to 60,259 at the end of the financial year, representing a connection of 539,000 lamps and 26,900 KW. for motive power users. The total receipts amounted to £430,000, as compared with £284,000 in 1915-16, but as the working expenses totalled £444,000, as against £273,000, a loss of £14,000 was incurred. The main cause of this state of affairs lay in the price of coal, which was £3 18s. 5d. per ton during the year. Every effort was made to counteract the effects of the high price of coal. In the case of industrial consumers, these had agreed in future to pay per KW.-hour according to the variation in the price of coal. Negotiations had been begun with the lighting consumers and small-power users, and with the 25 towns served by the company, with the object of securing higher prices. In the case of the towns an arrangement had been made, and was now only awaiting the approval of the superior authorities, whereby a provisional increase with retroactive force from April 1st, 1915, would be introduced, starting from coal at the price of £1 14s. 3d. per ton. The debit balance for the year, which has been carried to a suspense account, amounts to £56,000, and is composed of the before-mentioned loss, plus interest charges, interest, and redemption of loans and premiums on loan securities drawn for redemption. This position compares with a deficit of £25,000 in the previous year, which was extinguished by drawing upon the special reserve fund.

Yorkshire Electric Power Co. In their report for the year ended December, 1917, the directors give the following particulars:—Net profit after payment of mortgage and other interest:—1915, £21,209; 1916, £29,112; 1917, £33,258, plus £3,866, making £37,124 available. After paying 6 per cent. on the preference shares, and 5 per cent. on the ordinary, £12,000 is transferred to general reserve, carrying forward £4,392. The company continues to make substantial progress, and the dividend (5 per cent.) compares with 3 per cent. for 1916. There have again been material increases in the cost of labour and supplies. In November, 1916, a turbo-alternator of 6,000 KW. was put on load, and an additional machine of the same output has been ordered, and is now being erected.

To meet the cost thereof, and of considerable extensions to the company's plant and mains in the southern portion of the area of supply, the Ministry of Munitions have agreed (in addition to the £60,000 mentioned in the last annual report) to lend to the company further amounts not exceeding £122,000, which will be secured on the plant and mains so erected.

Agreements have been made to give a bulk supply to the Spenborough and Elland U.D. Councils, and to Electrical Distribution of Yorkshire, Ltd., for supply in the urban districts of Featherstone, Garforth, Horbury, Otley, Penistone, Rawdon, Selby and district, and Stanley; supply to these undertakings of the Distribution Co. will not be commenced until after the war.

The buildings, plant and mains of the company have been maintained out of revenue.

The demands for electrical energy have been heavy during the past year, and large developments in various parts of the company's area are being made, which will call for further supply from the company's mains.

To enable these developments to be dealt with the directors have secured a site at Ferrybridge, near Knottingley, on which to erect a generating station with large units of plant. The position of this site is shown on the plan attached to this report.

Of the issue of £71,640 of 6 per cent. cum. pref. shares authorised in September, 1916, £52,890 has been taken up to the end of the year, leaving £18,750 available.

The sinking fund, providing for the redemption in 1937 of the debenture stock of the Yorkshire Waste Heat Co., now amounts to £5,542.

Kalgoorlie Electric Power and Lighting Corpn., Ltd. Owing to war delays it may not be possible to hold the general meeting until July, but from information received it is calculated that the net income of the past year will be nearly £4,000 below that received in 1916.

This large decrease is mainly due to the shortage and the refractory attitude of labour, which, with other causes, prevented the mines from producing the usual tonnage of ore, thereby lessening the demand for electric current. There has also been a further increase in the cost of all supplies, which is another factor in lessening the profit for the year. These disadvantages have been most markedly conspicuous during the last quarter of the year, the cabled returns indicating a reduction in receipts of some £1,400 compared with the corresponding period of the previous year. In view of the smaller profit and of the arrangement entered into with the debenture holders to appropriate the first profits made during the current year, to the amount of £7,500, for a further repayment to them, the directors have decided that they will not be justified in paying the usual dividend to the preference shareholders in April next. It is hoped that when the obligations to the debenture holders have been provided for there will be a sufficient balance of profit remaining to enable the directors to recommend the payment of a dividend.

The debenture debt has now been reduced to £30,000, therefore, though the payment of dividends is for the time being suspended, the position of the shareholders is improved. It is expected that in four years the whole of the debenture debt, which is the only prior charge, will be repaid, and then the entire sum of distributable profit will be available for dividend to the shareholders.

Oriental Telephone & Electric Co., Ltd.—The directors are issuing a circular to their shareholders announcing that the Telephone Co. of Egypt, Ltd., has accepted an offer from the Egyptian Government for the purchase of its undertaking at a price of £755,000. The purchase has been approved by the Council of Ministers. The details of the contract are under discussion, and as soon as it has been signed further particulars will be published. After the payment of the debentures of the Egyptian Co. and the liquidation of all other claims upon that company, almost the whole of the net proceeds will belong to the Oriental Telephone & Electric Co., Ltd., which owns practically the whole of the shares in the Egyptian Co. The application of such proceeds is under consideration, and proposals will in due course be submitted to the shareholders.

Metropolitan Railway Co.—Results for 1917: Gross railway receipts £1,166,414, expenditure £745,928, miscellaneous receipts £190,196; total net income £610,682, plus £14,492 brought forward. Interest, rentals, and other fixed charges and appropriation to renewals absorb £305,314; dividends on preference stock, £239,107. Dividend on the ordinary stock £1 per cent. for the year, leaving £16,101 to be carried forward. £20,000 has been put to general renewals fund.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended November 30th, 1917, amounted to 2,479,429, compared with 2,366,060 in the corresponding five weeks of 1916.

National Gas Engine Co., Ltd.—Final dividend 3¾ per cent., and bonus of 1s. per share, on the ordinary shares, making 12½ per cent. for the year, free of tax.

St. James's & Pall Mall Electric Light Co., Ltd.—Balance dividend of 3s. 6d. per share on the preference (7 per cent.) shares, and 5s. 6d. per share on the ordinary, making a total of 9 per cent. for the year.

STOCKS AND SHARES

Tuesday Evening.

Lombard Street has marched into the area of financial politics once more as a live consideration by reason of the cheapness of money. Although the discount rate is maintained at 3½ per cent., there is what the market calls "money over" almost every evening, and this is having its effect upon short-dated securities as well as upon investment stocks as a whole. At the same time, there is not much business doing. Naturally, the economic and Labour situations in Germany are being watched with the keenest interest. For, although strikes are not unknown over here, they assume much greater importance in Germany by reason of the contrast which exists between the two countries in the way of freedom of speech. Therefore, the investor waits, and in the meantime puts as much money as he can spare into one or other form of Government borrowing.

The home railway market has slipped into a condition which approaches the parlous. Those who have maintained their faith in it for a long time past, begin to yield to the feeling that there is nothing to go for, and that the obvious uncertainties attached to Labour possibilities after the war is over, outweigh the good rates of return which many of the stocks pay at current levels. Therefore, prices are dull, and, although the argument does not apply to electrical companies with anything like the same force as its does to the steam railways, the one reacts upon the other. The abolition of halfpenny fares on the 'buses cannot fail to have a favourable effect upon the takings, and in the Underground issues, the Central London assented stocks are all 2 points up. Rumours are afloat as to a possible taking over by the London General Omnibus Co. of one of the smaller 'bus concerns, and details are expected to be made public in the course of the next few weeks.

The electric supply shares are a good market, and rises have occurred this week in St. James's and Westminster to 7¼ and 6⅞ respectively. Westminster's increased dividend making 9 per cent. against 7 per cent., is a strong bull point. Other quotations are also better than they look, although no quotable alterations occurred. There is a good deal of activity in Edison Swan shares, and, although each successive rise is met by a certain amount of profit-taking, the shares offered are readily absorbed, and the market shows considerable resiliency. The £5 shares stand at 2⅝, and the £1 shares, in which most of the speculative interest is centred, have hardened to 33s. British Westinghouse Preference, which generally move in sympathy with Edisons, remain at 56s. 3d., and it would appear as though there were a few shares to be realised on the part of those who got in some months ago when the amalgamation-of-interests idea was first mooted, and who have been fidgeting to get out of their shares because the price did not immediately respond.

South Metropolitan Ordinary are wanted at 22s. 6d., and the demand has served as a reminder that the company's relations with the County of London Electric Supply may materialise into still closer association sooner or later.

Marconis are once more on the move, and the parent shares advanced to 62s., which is, of course, ex the dividend recently declared. Americans are a rather better market at 24s. 9d., although in their case the price is held in check by the fact that there remain a good many speculators who bought them when they were extensively tipped in Stock Exchange circles, and who are waiting for an opportunity to get out at good prices. Other members of the Marconi group attract little attention, but the market seems to be a firm one generally.

Oriental Telephones have risen no less than 7s. 6d. to 3½, on the expectation that the Egyptian Government will take over at a very good price the part of the company's undertaking situated in Egypt. Chile Telephones maintain their recent improvement. West India and Panama further spurted, this time to 36s. 3d., and the reason for the advance is still somewhat obscure. Some are hoping for an increase in the dividend; others profess uncertainty whether the sixpence a share will be repeated this time. Eastern Ordinary is a point to the good. The Anglo-American group keeps very steady.

Brazilian Tractions have been up to 46, and at 45½ they still retain a rise of 1½ on the week. Anglo-Argentine Trams are firm, with another small recovery in the first preference shares. Nothing fresh has occurred to disturb the dulness of Mexican and Canadian Utility companies' issues.

Castner-Kellners have jumped to 3 9/16, a gain of 5s., due to the impression that the shares had been overlooked in the recent buying movement of other chemical descriptions. British Insulated ordinary are also 5s. better at 3½, there being a pronounced shortage of supply. Telegraph Constructions are really harder, although the nominal price remains at 42. Engineering varieties are mostly good, and the armaments have also taken a turn for the better. Rubber shares continue dull and out of favour, the price of the raw material keeping buyers out of the share market. Base-metal mines are strong, with the Cornish tin and Broken Hill groups very much to the fore.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Feb. 5, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3⅜	—	6 13 4
Chelsea	4	8	2⅞	—	5 4 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 5 10
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	5⅜	— ⅛	5 18 6
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	8	7¼	+ ¼	5 10 4
South London	5	6	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	6⅞	+ ¼	6 11 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94½xd	—	6 7 0
do. Def.	33/6	1½	12½xd	—	6 13 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	[illegible]	8	15⅛	—	*5 6 0
Eastern Tel. Ord.	8	8	151½	+ 1	*5 5 7
Globe Tel. and T. Ord.	7	7	1⅛	—	*4 19 1
do. Pref. ..	6	6	10⅛	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	[illegible]	51½	—	6 6 8
Marconi	10	[illegible]	3 1/16xd	—	4 16 1
Oriental Telephone Ord. ..	10	10	3½	+ ⅜	2 17 2
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan.	6d.	6d.	1 13/16	+ ⅛	*2 15 2
Western Telegraph	7	8	15½	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	64½	+2	6 4 0
Metropolitan	1	1	22½	— ½	4 9 0
do. District	Nil	Nil	15¼	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	8½	— ½	*4 18 2
Foreign Trams, &c.					
	1915.	1916			
Adelaide Sup. 6 per cent. Pref.	6	[illegible]	4⅞	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	+ 1/16	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	[illegible]	—	7 11 6
Brazil Tractions	[illegible]	[illegible]	45½	+1½	—
Bombay Electric Pref.	6	6	9¼xd	+ ⅛	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	43	—	11 12 4
do. do. Preferred	Nil	Nil	29½	+1	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	60	+2	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	33½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	—	4 12 4
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	3½	+ ¼	5 14 4
British Westinghouse Pref. ..	7½	7½	2 13/16	—	5 6 9
Callenders	20	20	15	—	6 13 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 9/16	+ ¼	5 12 2
Edison Swan, fully paid ..	—	—	2⅝	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1½	—	6 13 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19	—	5 5 3
Henley	25	25	17	—	7 7 1
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14⅜	—	*6 15 7
Telegraph Con.	20	20	42	—	*5 14 3

* Dividends paid free of income-tax.

MIDLAND RAILWAY ELECTRICS.

An interesting article recently appeared in our contemporary, the *Commercial Motor,* on the subject of electrics in railway service.

This article deals particularly with electric vehicles put into service by the Midland Railway Co., which has really pioneered in the use of the "electric" on a commercial scale for railway goods and parcel delivery, just as it has pioneered in many other directions of railway work.

For many years past, says our contemporary, this company has been deliberating upon the motorisation of its street traffic as a whole. Elaborate data have been collected, and during 1914 the preliminaries were completed, and all was ready for the launching of the new scheme; it only remained to ascertain how far the data were supported by practical applications. The company had to decide between three competing types of power vehicle, operated by steam, petrol or oil, and electricity respectively, and it chose the latter.

30-cwt. "Edison" Parcel Van.

In June, 1915, the introduction of a number of 30-cwt. parcels "electrics" and lorries of its own, following on trials during the previous Christmas season of similar vehicles in the Metropolitan area, decided the company, and at the moment it owns a fleet of 76 electric vehicles, which are operating in London and several provincial towns. Not only the Midland, but other companies who have studied the results, are awaiting a decided reduction in the cost of the vehicle before going further, says our contemporary.

The Midland Co. operates 21 petrol vehicles as well as some steam-driven ones, but experience has shown that the electric alone is able to fulfil the duty for which it has been selected, to the best advantage, *i.e.*, that of eliminating the horse.

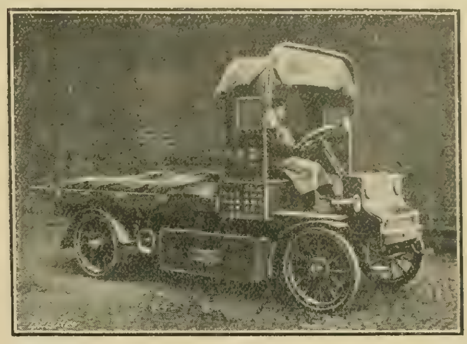
2-ton "G.V." Goods Lorry, with Ironclad-Exide Battery.

For city and town work, so far as it affects railway use, the electric has things all its own way; it accelerates quickly, and is able to take advantage of breaks in the moving traffic in a way which the petrol vehicle, with its change-speed gear, cannot do.

A test of petrol and electric vehicles of similar capacity, starting side by side from rest, showed that the latter travelled over 80 ft., while the former covered only 60 ft., and it is this ability to speed-up in the short gaps of crowded street traffic which constitutes its advantage, even over the petrol vehicle under such conditions. Our readers may recall that the celerity with which the "electric" can get away constitutes its chief recommendation for fire-brigade use, and that it has proved its superiority beyond doubt under such conditions. The railway in question has proved this in another manner. There was at one time a considerable volume of traffic flowing between Woolwich and St. Pancras, and both petrol and electric vehicles were employed in the service, the former having a speed rating of 20 m.p.h., as against the 12 m.p.h. maximum of the latter; yet the running time between the two showed no appreciable difference, proving conclusively that the petrol vehicle is deprived, owing to street congestion, of its high turn of speed, while the electric, on the other hand, profits from its lower maximum rating and more rapid acceleration.

Even in moving bulk loads between two points there is a minimum distance at which the petrol is inferior to the electric vehicle.

At Sheffield the railway depôt is situated in a basin; four electrics, two 2-tonners and two 3½-tonners respectively are doing satisfactory service on the hilly routes.



2-ton "Detroit" Goods Lorry, with Edison Battery.

The inflated cost of petrol is not such a serious factor in the cost of using the petrol vehicle with the Midland Co., as it is able to produce a fair proportion of its own liquid fuel from the manufacture of gas for railway carriage lighting, and at a cheap rate.

The main fact, however, is the striking displacement of horses; in the London area some of the lighter electric vehicles are doing work which formerly required the combined effort of six horses, and the Metropolitan costs are showing a good saving as a result of the conversion.

The operation of the electric vehicle, as is well known, can be mastered by the average man in a few hours, and this is a distinct advantage to the railway staff making the change, as the withdrawal of railwaymen for the special training required by drivers of petrol vehicles would dislocate the ordinary routine work, and skilled men from outside would, on the other hand, have to learn the railway business.

Midland Parcel Electrics under Charge.

Railway deliveries fall into two broad classes, *i.e.*, personal passenger baggage or parcels, and merchandise sent by goods train. The Midland Co.'s experience points to 3½-ton ele-tric vehicles as best suited for goods traffic, if a standard vehicle were required. The company's London traffic now employs 54 electrics, viz., 15 15-cwt., two 1-ton, and nine 1½-ton parcel vans for passenger traffic; also 15 2-ton, seven 3½-ton, and six 5-ton lorries for goods traffic.

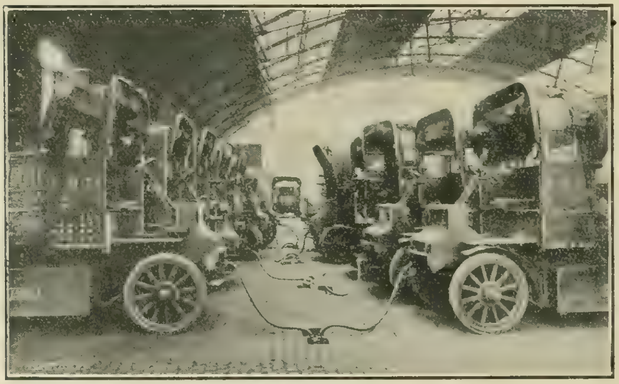
Our contemporary publishes the accompanying table, setting forth the average annual costs of maintaining and working the electric vehicle fleet of the Midland Railway, during 1916, the figures including all charges except wages of drivers and attendants.

	Lead battery.						"Edison" battery.												Petrol.		
	2-ton.			3½-ton.			2-ton.			3½-ton.			30-cwt. parcel van.			15-cwt. parcel van.			25-cwt.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Current (or petrol)	33	10	0	45	0	0	42	0	0	56	0	0	25	0	0	11	10	0	99	0	0
Tires	22	10	0	32	0	0	22	10	0	32	0	0	16	5	0	6	8	0	17	0	0
Repairs	20	0	0	25	0	0	20	0	0	25	0	0	16	0	0	9	11	0	40	15	0
Maintenance, including battery attention	11	0	0	12	0	0	10	0	0	11	0	0	4	6	0	4	6	0	15	10	0
Oil and stores	2	0	0	2	0	0	2	0	0	2	0	0	1	5	0	1	5	0	5	5	0
Standing charges	140	0	0	165	0	0	125	0	0	156	0	0	102	0	0	63	0	0	40	0	0
	£229	0	0	£281	0	0	£221	10	0	£282	0	0	£164	16	0	£96	0	0	£217	10	0
Cost per mile...	5·73d.			6·74d.			5·3d.			6·76d.			3·95d.			4·61d.			5·2d.		

Wages are eliminated because the drivers belong to either the general superintendent's, or goods manager's staffs; moreover, the wages item is a variable factor, as a man, a man and a boy, or two men may be employed, while sometimes two shifts are worked, the vehicle being in service for 20 out of 24 hours. Similar charges would be incurred with steam or petrol vehicles.

For purposes of comparison, the working cost of a 25-cwt. petrol vehicle is also included; the level of cost is not due to inflated fuel charges, as the fuel is assessed at 2s. per gallon, and, as a rule, petrol vehicles have longer runs than electrics.

For the electric vehicles, energy for battery charging averages 1d. per unit; and no difficulty is experienced in covering the 10,000-mile tire guarantee. The figures represent the first year's experience of the company with electric, and more attention was given to overhaul, &c., than is now regarded as really necessary; also considerable expenditure was incurred in making good damage due to accidents which occurred in congested railway goods yards. Mechanical repairs are insignificant as a rule.



Charging Electric Vehicles at the Midland Depot, St. Pancras

The standing charges are inclusive of interest, depreciation, or provision for renewal of the chassis, body, and battery; battery figures are based on manufacturers' guarantees, and as regards lead batteries, which are guaranteed for two years, experience points to decreased rather than increased charges.

The company is giving an extended trial to the Edison and lead batteries, and, so far as circumstances allow, the two are being run side by side, and carefully compared. The company's experience is that the Edison battery, while having a longer guarantee and life than the lead battery, is at a disadvantage where current is relatively dear; wherever the company can purchase energy at less than 1d. per unit, the former holds the advantage. Moreover, the Edison battery requires less attention, and its useful life being longer it avoids some of the trouble which may arise at more frequent intervals towards the end of the shorter life of the lead batteries. But the company's experience shows that there is little to choose between the two types, and the table shows but little difference in operating cost.

This table is based on a 10,000 mileage, but this was exceeded by two of the parcels vans, one of which covered 18,000 miles during the year; it is also anticipated that the 2-tonners engaged in goods service will exceed the total. For battery charging at the depôt, there is merely a plug and flexible connection either to a wall fitting or to one sunk in the ground, the energy being metered on the vehicle.

Some of the smaller vehicles in London cover 50 miles a day on one charge, and put up a weekly running record of 200 miles. Our contemporary points out that there are many who will persistently maintain that a large proportion of the work which is being fulfilled by electrics can be carried out by petrol-driven machines. But the Midland Co. has the records of its fleet of 21 petrol vehicles, which have been run on an equally systematic basis, and with a distinct advantage as regards liquid fuel, as electrical energy from the available generating station is charged at the prevailing price, yet the company declares that "the figures, more especially as regards total cost per annum, are distinctly in favour of the electrics. The costs per mile are also in favour of electrics, notwithstanding that the petrol mileage is very much higher than that of the electric in most cases. It should, of course, be understood that the electric and petrol machines come into competition in the same field only to a limited extent, though electrics in comparison with petrols show more favourably all round under present conditions than is normally the case.

It is generally agreed that the petrol vehicle scores in moving from point to point under full-load conditions over an appreciable distance, but the company maintains that electrics also show favourable results under such circumstances, and for moderate distances they consider them equal to the petrol vehicle. "For such work they would gain by being geared for speeds appreciably higher than those for which they are customarily fitted, and might require somewhat larger batteries in consequence of these high speeds."

The main point at issue, however, is whether the electric vehicle is the most suitable one to displace the horse, and under the conditions of railway delivery work in streets, the petrol machine has proved unsuitable. The high petrol consumption for the distances traversed upon a horse round, the stops and delays in traffic, the heavy wear and tear, combined with the necessity to perform the greater part of the round upon low and intermediate gears, are against the petrol vehicle.

However, as our contemporary rightly suggests, the petrol enthusiasts, far from decrying the electric, should welcome it as a mean of transforming slowly-moving street traffic into something better, which will in the end serve to benefit all motor-driven vehicular traffic.

In conclusion, we are indebted also to the chief mechanical engineer's department of the Midland Railway Co. for the accompanying views, and for their kindness in scrutinising the data contained in the article.

Japan's Electrical Industry.—Since war broke out the Japanese manufacturers of incandescent lamps have developed their export trade rapidly; in 1916 the value of their lamps exported was £67,000, and in 1917 it was estimated at £250,000. Just before the war lamps were not exported, but imported to the value of £30,000. Large up-to-date factories have been erected, and labour is exceedingly cheap.—*Electrical World.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Fractionating Hydrocarbons.

Leon E. Hirt, of Los Angeles, Cal., has patented an apparatus for fractionating hydrocarbon oils, in which the oil to be fractionated is subjected to the action of an electric arc within a closed furnace or retort, in which a controllable pressure may be maintained. Hydrogen in some form or other suitable agent is present in the retort, the reaction between the hydrogen and the oil taking place under the heat of the arc. The oil vapours thereby produced are conducted away and condensed. Referring to fig. 1, the fractionation takes place in the furnace or retort chambers designated 3, 4, and 5. Positive pressure of any desired degree can be created within the chamber by regulating the discharge of the vapours to the offtake 7. In the form of apparatus shown, the ingoing oil is preheated in the chamber 8 to a high degree, since the temperature of the outgoing vapours will be high, depending upon the rate at which oil, either atomised or as a vapour, is fed in. The outgoing temperature can thus be held between 600 and 1,500° F. The oil will therefore be discharged into the furnace chamber largely in the form of a vapour, and any unvaporised oil will be atomised by the action of the superheated steam passing through the nozzle. The pump 10 will maintain the oil pressure at the desired intensity, and as the oil and steam pass the arc, the oil is partly broken up and fractionated. The steam introduced with the oil becomes more or less dissociated, the nascent H_2 so formed entering into the reaction with the oils, and by providing the requisite pressure in the furnace chamber, any desired thermo-chemical compound of the oils can be formed. The O_2 liberated combines with carbon to form CO gas; this is preferable to carbon in the free state, since the latter clogs up the furnace and discolours the condensed fractions. Free chlorine gas may be introduced with the oil, or oil and steam, to unite with the carbon and form carbon tetrachloride, which can be recovered and used as a cleaning compound. Bromine gas may also be added either with or without steam. The halogen gas may be inserted through a pipe, as indicated at 18.—*Met. and Chem. Engineering.*

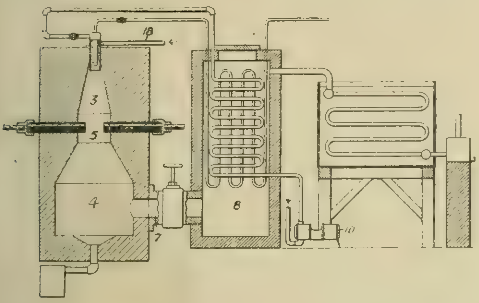


Fig. 1.—Diagram of Fractionating Apparatus.

The Electrical Precipitation of Dust.

The Cottrell process of precipitating the fine dust carried by gases is operated with a unidirectional current of from 40,000 volts to 100,000 volts, which is derived from alternating current and rectified by means of mechanical rectifiers or commutators. Standard apparatus has been developed by the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa.; for this purpose motor-generator sets are generally supplied. The current generated is 60-cycle, single-phase, and can be adjusted from 110 to 250 volts by means of a field rheostat. Standard capacities are 15, 25, 40 and 75 k.v.a.

The transformers are made in standard sizes of 15, 25, 40 and 75 k.v.a. for 60 cycles and 10 k.v.a. and 20 k.v.a. for 25 cycles. Standard high-pressure voltages are 40,000, 60,000 and 100,000. Each transformer has five standard low-voltage taps, giving 50, 62½, 75, 87½ and 100 per cent. of full voltage respectively. Full rated capacity is obtainable on each tap. Careful protection against static surges has to be provided; each transformer has a small oil-immersed choke coil mounted within the case between the end turns and the high-voltage windings, and transformers for over 50,000 volts have in addition choke coils mounted outside the case on each of the high-pressure terminals. Condenser-type terminals are also used on transformers for 50,000 volts and over.

Receiver for Submarine Sound Signals.

German patent rights have been granted to Dr. E. F. Huth (Berlin), for the receiver for submarine sound signals shown diagrammatically in the accompanying sketch, fig. 2. The novelty in this receiver, which is claimed to possess unusual capabilities of tuning and freedom from interruption, consists in the provision of a special resonator between the body exposed to the sound waves travelling through the water (*e.g.*, the hull plates of a ship) and an independently mounted receiving device (*e.g.*, a microphone). The resonator does not touch the hull plate and is capable of being tuned. The coupling between resonator and hull plate *a* is varied by altering the distance between them. The natural frequency of the resonator may be varied by sliding the tube *b* to and fro. When the tuning is correct, a weak received impulse sets up oscillations subject to very slight damping. These set in motion the diaphragm *d*, which is coupled mechanically to a microphone *e* in the receiving telephone circuit *f*.

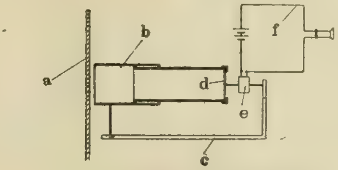


Fig. 2.—Section of Receiver.

Heating Long Tubes Electrically.

The accompanying illustration shows a method employed to harden steel tubes 15 ft. long. A is an asbestos-lined box, and by sending a low-voltage current through the tube B it was an easy matter to get the required heat. The lever C on the left operated the clamps on top and bottom of the tube. When the required heat was reached the tube was dropped in an oil tank that was sunk in the ground. The only difficulty we had was to keep the oil cold, but this could be easily overcome if production warranted. One great advantage of this method was that the tubes were heated uniformly throughout their entire length.—F. T. Schell, in the *American Machinist*.

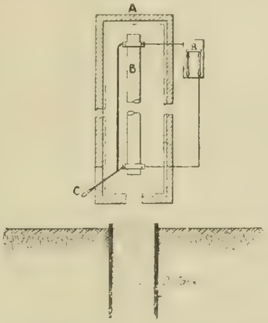


Fig. 3.—Electric Heating Device for Tubes.

LEGAL.

Liability for Tramway Passengers' Luggage.

Judge T. P. Perks has given judgment, at the Leeds County Court, in a case in which £10 17s. 7d. was claimed for a parcel that had been lost from a Leeds tramcar on which the plaintiff was a passenger. It was stated that plaintiff placed a parcel, weighing between 16 lb. and 18 lb., on the rear platform of the car, and paid the conductress 1d. for carriage. A few stages later on the journey the conductress informed the plaintiff that the parcel had fallen off the car some distance away. The car was stopped, and a search was made for the parcel, but no trace of it could be found. The plaintiff's solicitor argued that the Corporation were bailees for the purpose of carrying the parcel for reward, and that there had been negligence on the part of the conductress.

The Conductress, in evidence, denied that she gave the plaintiff a ticket for the parcel or received any payment for it.

Mr. Clifford Dunn, from the Leeds town clerk's department, who appeared for the Corporation, said that a passenger travelling on the tramways might take with him personal luggage not exceeding 28 lb. in weight without any charge being made for carriage, the responsibility resting with the passenger. It would appear, however, that the parcel in question was merchandise, and although his contention was that no charge had been made, the defendants had no right to carry it free, as it was not personal luggage. The tramways were not common carriers, and had not the liability that common carriers had.

His Honour held that the plaintiff had not proved that the parcel was paid for as merchandise. On the other hand, the evidence showed that the conductress had not been guilty of negligence. He therefore returned a verdict for the defendants.

BRITISH THOMSON-HOUSTON CO., LTD., v. DURAM, LTD.

(*Continued from page* 107.)

THE hearing of the appeal in this case continued during last week in the House of Lords. The whole of Tuesday (January 29th) MR. WALTER was reading evidence. He said the trial Judge had held the appellants' patent invalid for want of subject-matter. That was a decision which must, if it were to stand, have been arrived at on evidence that the Judge had before him, and was entitled to give weight to. He hoped that when the evidence had been considered *seriatim*, the House would agree with his submission that there was no such evidence at all, and therefore the ruling that the patent was invalid was erroneous, and must be reversed. The learned counsel had not nearly finished dealing with the evidence from this standpoint when the further hearing was adjourned.

On January 31st MR. WALTER concluded his argument. He submitted that there was no evidence upon which the Courts below could hold that the patent was invalid for the reason alleged by the respondents. He dissected the evidence given at the trial, and then went on to deal in detail with the specification. He argued that it disclosed a perfectly good patent, and the Courts below were in error in thinking that the whole "patent" consisted in working the tungsten metal bar when hot. If that were the crux of the "patent," he should not be there to support its validity, because it was common knowledge that metal could be worked when at a certain heat that was unworkable at a lower temperature. The specification must be read as a whole, and, so read, disclosed a perfectly good patent.

MR. COLEFAX, K.C., followed on the same side.

MR. TERRELL, K.C., for the respondents, began by showing what was common knowledge with regard to tungsten at the time that the patent was granted in 1906. After the respondents had put in an amended defence they, to avoid inspection of their works, made a formal admission on the issue of infringement in these words:—"The defendants formally admit for the purposes of this action that they in the course of their manufacture of tungsten wire subject the metal tungsten in a coherent form to the action of heat while it is being operated on or manipulated." This admission, counsel stated, followed precisely the words of the first claim of the appellants' specification. Therefore, the alleged invention claimed in the specification was in respect of ductile or malleable tungsten for whatever purpose it was to be used.

To that claim the defendants pleaded (1) that the alleged invention was too wide and general, and that there was no subject matter for a patent disclosed, having regard to the common knowledge of metallurgy in general and of tungsten in particular; and (2) that the invention described and claimed had been anticipated. It was so wide that it could include any manner of working, whether by forging, hammering, rolling, or drawing coherent tungsten (however obtained in a coherent form and at any degree of temperature) "while it was being operated upon" in any manner. In short, all the specification consisted in was an alleged discovery that tungsten could be worked hot. The fact that tungsten could be made coherent by many methods was common knowledge all the time. Therefore the specification involved no invention such as was required to support a patent in law.

MR. KERLY, K.C., followed on the same side, and addressed the House also on February 4th and 5th.

MR. WALTER then replied on the whole case.

(*To be continued.*)

Electricity Direct from Coal Gas.—S. Albert Reed, of New York City, in patent No. 1,225,175, discloses an electrolytic cell which amounts substantially to the production of electricity direct from coal gas. The principle of the method is to dissolve in an electrolyte of fused borax the oxide of a metal such as manganese, which forms easily two or more oxides of different degrees of oxidisation, and readily passing from a lower to a higher degree of oxidisation when in contact with air, and from a higher to a lower when in contact with a reducing agent, such as fuel gas. When the solutions of a higher and a lower oxide are brought into liquid contact at any point, a difference of electrical potential results, and if an appropriate electrode is immersed in each of the solutions a current of electricity will pass in a conductor joining them, so long as the difference of oxidisation respectively in the two solutions is maintained. The E.M.F. obtained when the electrodes are of platinum, and the metallic oxide in solution is an oxide of manganese, is approximately 1 volt, and current is furnished at the rate of 15 amperes per sq. ft. of active surface and upwards.

In a heated chamber is placed a shallow dish of refractory earthenware, within which there is contained a smaller shallow dish of similar material forming a reduction chamber. A tube for supplying fuel gas is led into the inner chamber, and vent holes are also provided for the products of combustion. The electrodes are placed in the inner and outer portions of the borax electrolyte containing the separate forms of manganese oxide. So long as fuel gas is supplied to the tube the normal differentiation of the two oxides is maintained, and a current flows continuously through the circuit. The oxygen which oxidises the fuel is actually supplied electrolytically from the air taken up at the outer extended surface, such air being present inside the heated chamber.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,148. "Apparatus for testing setting of cams in ignition magnetos." A. F. MARSH & L. SELBY-WALLIS. January 21st.

1,172. "Transmitting keys for electric telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & V. A. SMART. January 21st.

1,219. "Renovation of interiors of electric battery dry cells." W. J. THORROWGOOD. January 22nd.

1,220. "Renovation of electric battery porous pots." W. J. THORROWGOOD. January 22nd.

1,242. "Electrical thermal vaporiser." D. G. MACMILLAN & J. P. B. O'REILLY. January 22nd.

1,246. "Railway traffic-controlling apparatus." MCKENZIE, HOLLAND AND WESTINGHOUSE POWER SIGNAL CO. January 22nd. (U.S.A., January 22nd, 1917.)

1,275. "Electric lamp socket." J. R. HANSFORD. January 22nd.

1,277. "Electric starting and lighting systems for automobiles." J. BETHENOD. January 22nd. (France, August 11th, 1917.)

1,301. "Incandescent electric lamps." A. MACCALLUM. January 23rd.

1,313. "Electric accumulators or storage batteries." F. HORNBY. January 23rd.

1,315. "Apparatus for electroplating articles having holes." PLATT BROS. AND CO. January 23rd.

1,318. "Telephonic apparatus." A. L. WILSON. January 23rd.

1,321. "Lamps or lanterns for aircraft." H. C. BROWN & FULLER ACCUMULATOR CO. January 23rd.

1,328 1,330. "Railway signalling." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. AND UNION SWITCH & SIGNAL CO. January 23rd.

1,329. "Railway train-controlling systems." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. AND UNION SWITCH & SIGNAL CO. January 23rd

1,333. "Swing bracket for electric lighting." W. J. REVELL. January 23rd.

1,359. "Self-generating electric power plant." J. DITCHFIELD. January 24th.

1,361. "Electric incandescent lamps." R. WHIPP. January 24th.

1,376. "Cooling dynamo-electric machines." ENCLOSED MOTOR CO., H. C. E. JACOBY & P. A. H. MOSSAY. January 24th.

1,377. "Step-by-step receivers working on the principle of magnetic gearing." BARR & STROUD AND C. D. MACGILL. January 24th.

1,387. "Ignition system." SPLITDORF ELECTRICAL CO. (U.S.A., May 18th, 1917.) January 24th.

1,399. "Electrical incandescent lamps." G. LAYTON. January 24th.

1,402. "Telephone receivers and transmitters." J. W. FERRIER. January 24th.

1,407. "Electric igniter for combustion motors." K. JAGGI. January 24th. (Switzerland, January 24th, 1917.)

1,430. "Electric fuses." B. THOMAS & E. THOMAS. January 25th.

1,440. "Brush connections for electric motors and dynamos." F. DAY. January 25th.

1,468. "Electric resistances." G. ELLISON. January 25th.

1,483. "Magneto motor." D. SUCHOSTAWER. January 25th.

1,493. "Machine switching telephone systems." L. POLINKOWSKY AND WESTERN ELECTRIC CO. (Western Electric Co., U.S.A., partly.) January 25th.

1,531. "Transmitter diaphragms." F. L. HOYT. January 26th.

1,539. "Electric attachment plugs." BRYANT ELECTRIC CO. & W. HUNT. January 26th.

1,540. "Electric lampholders." A. P. RUTHERFORD. January 26th.

1,567. "Plunger type brush-holder with pivoted head." A. H. BENNETT AND PHŒNIX DYNAMO MANUFACTURING CO. January 26th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

14,422. COMBINED PUMPS AND ELECTRIC MOTORS. Submersible & J. L. Motors, Ltd., & C. W. Durnford. October 10th, 1916. (112,287.)

14,423. ELECTRIC MOTORS. Submersible & J. L. Motors, Ltd., & C. W. Durnford. October 10th, 1916. (112,288.)

14,849. TYPE OF GLAND FOR PASSING ELECTRIC CABLES THROUGH BULKHEADS OR DECKS. J. H. Collie. October 19th, 1916. (112,289.)

18,552. APPARATUS FOR ADVANCING THE SPARK IN INTERNAL-COMBUSTION MOTORS. Soc. Anon. Pour l'Eclairage Electrique des Vehicules. September 9th, 1916. (Addition to 17,934/16.) (109,781.)

18,611. ELECTRIC ACCUMULATORS. I. Chkliar. December 29th, 1915. (102,976.)

1917.

38. METHOD AND MEANS FOR AUTOMATIC ELECTRIC CONTROL OF PETROL-ELECTRIC TRANSMISSION VEHICLES. P. F. Smith & V. S. Robinson. January 2nd, 1917. (Cognate application, 1,095/17.) (112,306.)

90. ELECTRIC LAMP OR OTHER VACUUM TUBE HAVING A COPPER LEADING WIRE. T. Yanai, G. Ohtani & S. Yago. January 26th, 1916. (103,648.)

368. APPARATUS APPLICABLE FOR ELECTRIC LIGHTING. Sir W. G. Armstrong, Whitworth & Co. and A. S. Cheetham. January 8th, 1917. (112,320.)

619. ARRANGEMENT OF THE IGNITION CHAMBER OF TWO-CYLINDER AND MULTI-CYLINDER INTERNAL-COMBUSTION ENGINES. J. G. Sandwall. February 10th, 1916. (103,985.)

2,407. STARTING INTERNAL-COMBUSTION ENGINES. J. J. M. H. Kluijtmans and A. M. H. Gardham. February 19th, 1917. (112,343.)

2,475. ELECTRIC SWITCHES. T. McLeod. February 20th, 1917. (112,344.)

3,486. ELECTRIC WELDING OR FUSION-DEPOSITION OF METALS. Quasi-Arc Co. and W. L. Coles. March 9th, 1917. (112,353.)

5,528. ELECTRIC INCANDESCENT LAMPS. S. Yuyama. April 19th, 1916. (105,764.)

6,023. ELECTROPHONES. S. M. Hyman & Stols Electrophone Co. April 28th, 1917. (112,366.)

7,557. TERMINAL FOR ELECTRIC CONDUIT. F. I. Johnson. February 14th, 1916. (111,834.)

10,072. ELECTROLYTIC ANODES. Electrolytic Zinc Co. July 26th, 1916. (108,311.)

10,588. CONTACT MAKERS AND INTERRUPTERS OF IGNITION SYSTEMS. W. J. Mellersh-Jackson (Philips Brinton Co., U.S.A.). January 4th, 1917. (Divided application on 177/17.) (112,391.)

11,035. ELECTRIC CIRCUIT CONTROLLERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) July 31st, 1917. (112,393.)

14,430. MAGNETO-ELECTRIC IGNITION APPARATUS. Akt. Ges. Brown, Boveri et Cie. October 31st, 1917. (111,100.)

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STRENGTH THROUGH UNITY DURING RECONSTRUCTION.

WE are not a political organ, and with politics as such we have no immediate concern. But we are interested, and deeply so, in large matters that bear upon the National well-being, and if we have to run the risk of being charged with intervening in political affairs because we touch upon a situation fraught with possibilities of great public danger —well let the charge be made and we can amply justify the intervention by appealing to the unprecedented times in which we are destined to live.

During the later period of the war we are supposed to have been governed by a Coalition Government. It was what some of us fondly desired to see in those days when we were divided off into so many party camps with a hundred-and-one controversies and quarrels about affairs which, amid present-day serious realities, appear comparatively small and pettifogging. When it became necessary to combine all our best forces in presenting a united front to defeat the ambitions of a strong and unscrupulous foe, party cries and party spirit were recognised as grit in the national machine, and we had no place for them if we were to run efficiently. Where do we stand to-day in regard to this matter?

From our careful study of the present situation and tendency, we observe that as the conviction becomes more general that we have entered upon the final stages of the war, there appears every few weeks, or indeed every few days, the ugly head of party. Rumours are prevalent of this or that development that is or may be in progress in the political world. We need not detail any of them, but we may be permitted to ask whether it will be right for the nation to return to anything in the nature of party political life for five years to come.

We are told by our advisers that there may be a general election not long after next July, when, under the Bill which has just been passed, many millions of men and women will be qualified to go to the poll for the first time. This, in the ordinary course, suggests a preparation of party political machinery and organisation, and therefore the preparation of rival programmes which, in view of the vast and critical character of the questions that are simmering and sometimes ominously threatening, may well divide the nation into hostile camps.

Considering the outlook with one interest at heart—the well-being of the nation—we do not contemplate the prospect with equanimity. First in order of time there will be the making of peace. How can we contemplate a party-spirit emerging in such a connection? If we have needed a coalition of forces to control or guide during the War, can we reasonably allow a party faction to exercise pressure in making the peace for which practically the whole of us have either worked or fought, borne sacrifices, or bled? It is unthinkable. The best men for War must be followed by the best men for making Peace.

Second in order of time, but hardly in our view second in order of importance, comes the period of Reconstruction. Is there a man amongst us, who, having entered at all closely into what that word implies, all the vast and delicate operations that it will involve, can face without tremor the critical possibilities, all that they may hold of good, all that they hold of evil, of those days? We cannot as reasonable men brush that question aside and indifferently suggest: "Oh! we shall all want to settle down to our own affairs again just as quickly as ever possible—things will shape all right!" True enough, numbers—perhaps the majority—of us will be eager to "settle down," but that process of settling down has to be facilitated, and there are those who are determined that it shall not be. We can hear old Shylock whetting his knife upon the stone already, and he will not scruple about the drop of blood unless there be the restraining influence of the strong hand of the nation. Who talks of "settling down" at all to anything with the menace of general ferment which return to party politics would only serve to encourage?

What, then, is the outstanding need for the days to come? With the freedom of a journal interested only in the highest good of the nation, of its industries, and of its workers, we emphatically protest against any developments which will give the people the signal to divide themselves off into opposite political camps. It may be that the troubles of the years of war will bring such a change among their inevitable aftermath. It may be that our human nature and some human ambitions will render us powerless to avoid it; or that the demand for efficiency requires an effective opposition. But we profoundly hope it may be found possible to avoid it, for in our conviction what Great Britain and Ireland and our Empire as a whole need, is a Government composed of all interests, including the best and most experienced minds, to guide the ship of State through unknown waters. If we have needed a coalition for securing unity in war, and require it for guaranteeing the interests of all in securing the right peace, we shall more than ever find it essential for securing unity and guaranteeing the interests of all in the period of reconstruction.

A New Association.

The movement towards the formation of an Association of Electrical Power Station Engineers was advanced a further stage on Thursday last week, when a conference was held at which the several existing Associations were represented. A summary of the proceedings is given elsewhere in this issue, from which it will be seen that the proposed Association will include all members of the technical staffs of electrical power stations in the Kingdom, from chief engineers to junior technical assistants.

It is generally felt, we believe, that the time is opportune for the establishment of such an association; it is by no means the first attempt to accomplish this aim, but up to the present all efforts have failed to bring about the desired result, owing to various causes, but mainly, it seems, to the lack of energy and enthusiasm on the part of the officials in whose interests the movement was conceived. We cannot but think, however, that in the light of recent events even the most apathetic station engineer must have realised the importance of the matter, and must be ready and willing to do his utmost to further the objects of the promoters. The indispensable condition which must be fulfilled before progress can be made is summed up in the one word—*Organisation*. Without this, nothing can be done to better the lot of the station engineer. He must work out his own salvation—unless he is prepared to place his interests in the hands of the trade unions to which his subordinates belong, and humbly to accept the crumbs which fall to his lot from their table, as in the case of the 12½ per cent. award, in which he has participated solely through their efforts. This, surely, is a humiliating position; better by far to join a trade union and frankly adopt its methods and ideals, than to stand by as the jackals stand by the lions, in the hope of securing an odd bone or two when the latter have made a kill. But best of all to stand on one's own footing, to support one's own association, and to be under no obligation to any other organisation whatever. There is no reason to fear that by joining the new Association one will be committed to the support of a policy of strikes or any other action repugnant to a professional man; friendly negotiation will suffice to attain the ends desired, provided —and this is the *sine qua non*—that the Association, by the numbers and qualifications of its members, acquires the standing and influence that are justified by the importance of their functions to the nation. Association is the very keynote of the time, and the need for it is more keenly felt as time goes on in every walk of life. The present circumstances afford the most favourable opportunity that could be imagined for the successful inauguration of the new organisation, and the need is pressing.

While we have tried to show that it is up to staffs themselves to take the initiative, we venture to appeal to the chief engineers and chief assistants of all electricity supply undertakings to give the movement their support. They are in a position to exert an immense influence on its progress, and upon them rests a very serious responsibility in this matter, in respect of the future position and prospects in life of their junior colleagues. They cannot regard the question as it affects themselves alone; they are by virtue of their position morally called upon to take care of the interests of their profession, and to do their utmost to elevate it. Moreover, though this argument is not the one to which we would have them give the most heed—whatever they do for the benefit of their juniors will inevitably react upon their own affairs and redound to their own advantage in the long run. We earnestly commend the proposal to their consideration, urging them on all grounds to support it not only with their sympathy, but by word and action.

Whitley Councils.

We are pleased to observe that the recommendations of the Whitley Committee respecting the relations of Capital and Labour are being more widely discussed in some of the great industrial centres of the land. The Committee made it clear that no hard and fast lines could be laid down for their application to the differing details governing particular trades, and the more widely that fact is recognised the more likely is the way to be smoothed for united effort in trying to find out the best ways in which machinery of some such kind may be established. There is still much ignorance concerning the proposals, and a good deal of suspicion amongst certain sections of Labour respecting the sincerity and consistency of the Government itself. The freest circulation of the report and the fullest publicity are great needs at the moment. We learn from the Board of Trade *Journal* that the Government recognise the impossibility of dealing with such questions as the scarcity of materials, demobilisation, difficulties of transport, &c., satisfactorily by departmental action, without the close co-operation of the representatives of the industries themselves. The *Journal* says that no doubt the proposed Joint Industrial Councils, the formation of which is being promoted by the Minister of Labour in accordance with the Whitley Report, will be able, when established, to voice the views of those industries for which they are formed, with regard to many of the questions referred to.

> But considerable time will be necessary for the universal establishment of these Councils, and it is highly undesirable to attempt to force the pace unduly. It is therefore necessary in the meantime to consider the formation of temporary and provisional Trade Committees to advise the Government as to the views and needs of the trades on the various industrial and commercial problems that will affect them during the reconstruction period.

It has, therefore, been arranged to convene joint conferences of representative organisations of employers, traders, and workpeople in a number of groups of trades to meet the Minister of Reconstruction, the President of the Board of Trade, and the Minister of Labour, with the object of considering the best way of setting up provisional Trade Committees for the purposes indicated. We read that steps are being taken, in consultation with the interests concerned, to draw up a provisional trade classification, and to make the necessary arrangements for the conference.

CONSUMERS' COMPLAINTS.

By "ROVER."

In every central station there is one member of the staff on whom the duties of Complaint Man or Claims Adjuster are thrust. As soon as the first batch of demand notes has gone out, the Complaint Man holds himself in readiness. The meter readers have already informed him of the most obviously increased consumptions, and the causes of the increases have been quietly investigated before the complaint comes in. Exceptionally dull days have been duly marked on the calendar, news and rumours of a consumer's increasing or decreasing business have been tabulated; and in some districts a man's early-rising habits are jotted down all ready for the time when he will consider his winter quarter's account much heavier than his neighbour's.

Sometimes consumers, when paying their accounts, give a grumble as to the quality of the light or its unsteadiness at certain hours. Such grumbles should not be allowed to be buried in the Collector's office, but should be passed on to the Mains Superintendent, and may enable him to spot a length of over-loaded distribution, or to locate a power user who is not dealing fairly by his motor. But as a general rule, complaints are made only of the amount charged, and it is the duty of the Complaint Man to satisfy the consumer that he has received and enjoyed the energy charged for. This is largely a matter of diplomacy. With most people it leaves an unpleasant feeling to assert bluntly that the energy has been consumed, and therefore must be paid for, as per agreement. It is necessary to assure the consumer that he or she is in some way abnormal and superior to his or her fellows, and for this reason the account is greater. An appeal to vanity can seldom be withstood. Of course, the truth is that the particular consumer is superior to his neighbours in carelessness and extravagance; but the Complaint Man has no such words in his vocabulary, and he gently hints that although the account is actually based on the consumption recorded by the meter, the consumer's own generous nature and unusual want of niggardliness are really responsible.

In most towns there is a well-to-do man who shuts up his house during four or five months of the year, and carelessly leaves a radiator burning all that time. Being well-to-do, he naturally complains when the bill is presented; but with such a steady consumption as a heater, it is fairly easy to check the amount of energy used, and to convince the consumer as to what has happened in his absence.

Knowledge of the social habits of the consumer is very useful to the Complaint Man. A complaint of heavy accounts from the fashionable quarter was met with the well-founded argument that a good deal of entertainment had taken place. This was countered by the equally well-founded assertion that there was sickness in the house during the whole of the period, and no entertaining was done. Unfortunately, it was added: "We had a day and night nurse all the time," and investigation proved that several lamps had been in use all night long.

In a town which is really a London suburb there is a short street where the houses are "as like as a row of pins," even unto the electric lighting. They are tenanted by clerks and others who are employed in the City, and the residents catch the same train in the morning, and return together at night. Not being chiefs, their office starting hours are not later than 9 a.m., and therefore they must leave home soon after 7 o'clock. Their accounts are all very similar, and, no doubt, form a topic of discussion on the train. One of these houses suddenly dropped its consumption considerably during two successive quarters, and, consequently, a quiet investigation ensued. It was found that the consumer, a clerk, had had a small legacy left him, and had temporarily given up work, and so had no need to get up early and burn the early morning current. The following winter he was in harness again, with his consumption the same as his neighbours'.

An instance in which the Complaint Man was fairly puzzled was as follows:—A consumer, after paying his bills without demur for some years, suddenly complained that his accounts seemed much higher than his friends'. His complaint seemed reasonable, and his meter was changed. The old one, an ampere-hour meter, was tested at the central station, and proved correct, and the consumer was informed to that effect. He accepted the ruling of the supply authority, and the old meter was placed in the stores. After some time it was discovered that it was really calibrated for a 440-volt circuit, though used on a 220-volt supply, and, consequently, had registered double the actual consumption during some years. The Claims Adjuster wrestled with his natural honesty for some time, but by dint of hard struggling he managed to forget the matter. Later on he heard through devious channels (and to his great relief) that the consumer had arrived at the conclusion that his new meter was under-registering considerably, and for that reason he (the consumer) kept very quiet on the subject of accounts. The name of the town, by the way, was *not* Commercial Morality.

A complaint by an Alderman of unsteady light naturally receives immediate attention when the supply is run by the Local Authority. In this case the worthy Alderman was not at home when "our representative" called, but his wife gave all the desired information. He had been using a table lamp in his study when he observed the flickering. Examination showed there was no wall socket for this lamp in the room indicated, and the news was volunteered that current was taken from a wall socket on the radiator circuit; a socket of quite different size and design. Two bent hair-pins showed how the connection had been made, and the good lady averred: "my husband got a nasty burn on his hand when he first used them." Bad contact on the part of the hair-pins explained the flickering. In this district energy for heating is supplied at about one-third the lighting rate, and the good Alderman received a tactful letter asking him not to repeat his felonious operation, and he would now find the pressure constant.

When the final notices for payment are sent out, certain gentlemen will awaken to the fact that their accounts are much in excess of anything they ever had before, and they will demand investigation and reduction before paying. These are the people who try to put off the evil day of payment, and must be treated with the firmness they deserve—payment first and investigation after. There may be one or two genuine ones amongst these tardy payers, but, as a rule, the consumer with a grievance gives vent to it as soon as he gets the first demand note.

Sometimes complaints, which at first sight appear absurd, have truth in them. One consumer—a born grumbler—declared that whenever a heavily-loaded tramcar passed his house, his lights went down. It was pointed out to him that the cars were supplied from a different source from his lighting, but he persisted in his complaint. To appease him, an electrician was sent to investigate, and reported a loose connection in a switch: the vibration set up by the tramcar as it passed caused a flickering.

It would seem, then, that there is no hard-and-fast rule for dealing with grumblers, yet investigation, consideration, and tact are always worth while. No consumer likes to be treated merely as a number in a ledger, and if it is possible to combine the sale of electricity with a little common humanity, it may mean a good deal more time and trouble, but it is, nevertheless, good business.

German Penetration in Switzerland.—According to a note in *L'Industrie Electrique*, Herr Walter Rathenau, head of the Allgemeine Elektricitats Gesellschaft and organiser of the mobilisation of Germany's raw materials, has paid a visit to Switzerland, with 600 employés, with the object of creating a trust of the whole of that country's electrical resources for the benefit of Germany. He has founded two companies, styled respectively the "Militaria" and "Metallum," the former to promote the production in Switzerland of war material for Germany, and both to render Switzerland dependent on Germany for electrical energy by means of the large electrical installations in German hands, and by the imports of German coal. The Metallum also aims at appropriating Swiss metal resources, by the agency of some 118 inspectors, 24 consulting engineers, and numbers of native Swiss agents distributed throughout various cantons, besides recruiting for work in the Fatherland at least 50,000 skilled Swiss workmen.

A CURIOUS CASE OF WEAR BY A LUBRICATING RING.*

By LEONARD HARDING, F.C.S.

It is only on rare occasions that engineers have been brought into touch with cases where steel has been worn by softer metals. In cases where there has apparently been wear of steel by a softer metal, it is quite possible that further investigation would have shown some other contributing cause.

Mr. Michael Longridge's report for 1902 contains an extract on this subject, and cites a case where a shaft was worn at the pulley end to such an extent that finally it sheared. An examination of the lubricating ring threw little light on the matter, as it was free from wear and had quite a normal appearance.

Another case, somewhat similar in character, came before the writer for investigation, and has certain interesting features which may prove instructive to the reader. It refers to the grooving by a brass lubricating ring of the mild steel shaft of a 20-H.P., 460-volt, three-phase motor. This motor, which was working in a colliery, was noticed to be emitting a peculiar noise, and it was accordingly shut down in order to ascertain the cause. On examination it was found that one of the two rings which ran parallel in the same slot was lying with a piece broken out of it at the bottom of the well. A new ring was therefore put in, but as the noise continued the motor was sent away to the works for further examination. It was then found that there was a groove in the shaft about $\frac{3}{16}$ in. wide and deep, which had all the appearance of having been turned in a lathe (see fig. 1, at X). No other wear could be observed except a slight groove at the other end of the shaft, which looked as though it would gradually be cut deeper in a similar manner to the other. The portion of the shaft running in the bearings showed no sign of wear, neither was there any evidence of lack of lubrication. It was evident on the closest investigation and inquiry that there was nothing wrong with the mild steel shaft, and it appeared at first superfluous to make a serious examination of the brass lubricating ring. However, it seemed that it must be the lubricating ring that was responsible for the trouble, and the broken ring was therefore passed on to the writer for examination and analysis. It was stated by the makers that the ring was of ordinary brass, containing 60 per cent. of copper and 40 per cent. of zinc, or thereabouts. Upon analysis it was found that the following represented the percentage composition :—

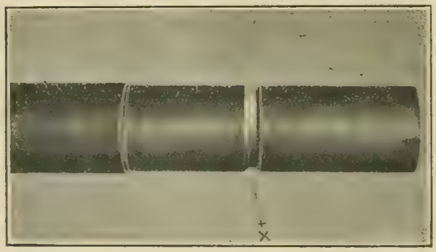

Fig. 1.

Copper	70·87	per cent.
Lead	5·47	„ „
Tin	1·54	„ „
Iron	1·26	„ „
Zinc (by difference)	20·86	„ „
	100·00	„ „

A casual examination of the broken ring was sufficient to detect a number of small particles of a shiny metal. These particles, which were less than a small pin head on the average, could be picked out and examined. They proved to be particles of steel, and were present at every little crest in the ring, as will be seen from fig. 2. It will be noticed on reference to the illustration that the ring has been worn in a peculiar manner, as though it had received a rocking motion. The reader will be able to see from the appearance of the ring how it has first ridden on the shaft on the embedded steel points and then been rocked on to the brass, thus giving it an undulated appearance. It is quite evident that the particles of steel became embedded in the ring during moulding, possibly due to using scrap metal, or maybe due to accidental contamination. Whatever may have been the cause of the impurity being present, it is clear that great care is needed in the preparation of lubricating rings to prevent the introduction of anything that might act as a cutting point.

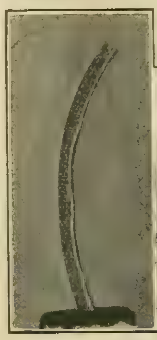

Fig. 2.

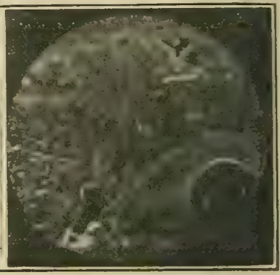

Fig. 3.

Fig. 3 is a photomicrograph of 200 diameters, showing the steel particles embedded in the brass. The three black patches are typical examples of the kind of particle that was found.

PROBLEMS OF INDUSTRY.

(*Continued from page* 125.)

How far is it practicable to introduce all the reforms that are desirable and reasonable? Organised labour will surely not fail to recognise that they will cost much money. "Seeing that we are so largely dependent on our foreign trade, in which prices are regulated by international competition, it is quite clear that we shall not be able to meet the bill unless we can effect drastic economies in production, and largely increase our output." Mr. Hichens gives a few telling points here which Labour will, we trust, carefully examine in that spirit of co-operation which is essential if we are to avoid the serious errors of the past. Again we quote :—

> If all strikes can be prevented and regarded, as they should be, as the unhealthy excrescence of a semi-civilised age, the addition to our national wealth will be very great. An average of 18 million working days per annum were lost owing to trade disputes in the four years before the war, to which must be added the indirect losses involved by the dislocation of industries not primarily affected. But an even greater gain will be made if the policy of restricting output is abandoned. The loss that falls upon the community owing to "slow timing" and indifferent workmanship is an oft-told tale, and I will not dwell on it. But disastrous though the policy is to the workers themselves, as well as to the rest of the community, we shall, I believe, be indulging a vain hope if we think it will be abandoned so long as the theory holds the field that Capital is entitled to the residuum of profit after the costs of production have been defrayed. Unless it is made unmistakeably clear that industry is run for the benefit of the whole community, and not for the enrichment of certain classes, restriction of output will continue, and the reforms that are so urgently needed will be sadly hampered. Similar in kind—and far less excusable—is the loss that falls upon the community owing to the existence of able-bodied drones, rich or poor, who contribute nothing to the common stock, but live in idleness upon the fruits of other men's toil.
>
> A third important factor in improved production is the substitution of up-to-date machinery for old, and the extension of labour-saving devices. Before the war, it often happened that it did not pay to introduce labour-saving devices, because, apart from the difficulty of raising fresh capital, the interest charges came to more than the cost of cheap manual labour.
>
> Just as we have been backward in substituting mechanical

> devices for unskilled labour, so we have been slow to replace antiquated with modern machines. In both cases want of capital, cheap labour, and the opposition of the workers have stood in the way.
>
> But it would be a mistake to suppose that the opposition to the reforms involved in the introduction of improved mechanical devices and improved organisation comes from the workers alone. Vested interests play an even more powerful part in thwarting progress, and ingrained habits present a formidable obstacle to far-reaching schemes of reform. It is essential, however, that all difficulties should be overcome, for the possible economies are enormous. Let me give a few examples taken at random. One of the paramount necessities of this country is cheap transport, and attention must be concentrated on reducing railway rates. Can anyone doubt that by standardising our locomotives and wagons; by establishing central coal depôts; by concentrating our goods yards; by substituting electric traction for locomotives in which only 15 per cent. of the original energy is utilised; by eliminating wasteful competition; can anyone doubt that, by a far-sighted scheme of reform, a vast field of economy may be opened up in the administration of our railways?
>
> But most important of all for industry is the supply of cheap coal and cheap motive power. In the report recently published by the Coal Conservation Sub-Committee of the Reconstruction Committee, they foreshadow a possible national saving of 100 million pounds sterling per annum.
>
> These are staggering figures, but results just as startling might be attained if attention were concentrated on mechanical improvements in other trades.

Mr. Hichens referred to the waste involved in unrestricted competition :—

> Certain forms of competition are healthy and cheapen production, but others are sadly wasteful. The rivalry in economical production—so long as wages, hours, and general conditions of work are safeguarded—seems to me healthy, and I believe that it is better for a country to have a large number of small manufacturers than a few big trusts; this also accords more with the genius of our race, whose sturdy independence and self-reliance has built up an Empire containing a quarter of mankind. Nor do I believe that the economies resulting from manufacture on a gigantic scale are very great. It is necessary, of course, that an economic unit of production should be established in each case, but the economic unit is not necessarily large. For example, many small firms have proved that they can manufacture shell at least as cheaply as the largest organisations. A great source of wasted energy to-day is that so many manufacturers are engaged in a miscellaneous trade, with no economic standards. A dozen firms may each be manufacturing a dozen types of articles at a loss, whereas, if each concentrated on one type, the loss would be converted into a profit. Moreover, standardisation of types has been sadly neglected, and quite unnecessary variations have been allowed to intrude themselves, merely because it is nobody's business to see that they are reduced to a minimum.
>
> But big selling organisations are undoubtedly more economical than small ones. What is wanted, therefore, I suggest, is big selling combinations, which should also promote research work, and a variety of manufacturing units. The money that is wasted every year in advertising, in travellers, in touting for orders by means which are often degrading, in over-production, runs into enormous figures. But the remedy of syndicating the produce of each industry is full of difficulty; it tends to stagnation, to the exclusion of new-comers, and to inflation of prices; for the evil of rings in the past has been that they have thought more of keeping prices up than of cutting costs down.

We have given these lengthy references to this address because we believe it to touch upon many matters that are of great importance in connection with the coming reconstruction of industry on a basis which may assure a "material prosperity far in excess of what has gone before, at a far smaller expenditure of effort." That fruit—material prosperity—concludes Mr. Hichens, is not intended for the exclusive enjoyment of one member, but for the whole body; therefore, we must not apply any tinkering scheme of piecemeal reform in the hope that it will avail to cure our ills. "The self-sacrifice of our soldiers and sailors must find its counterpart in our industrial life."

The James Watt Lecture has naturally evoked a certain amount of criticism, as have some other discourses of the same lecturer in which he has followed practically the same line, calling for a moral code in industry. We print part of a letter to the *Times* from a "Manufacturer." The writer says that Mr. Hichens suggests that the solution of the industrial problem lies beyond all economic laws and doctrines, and depends on our moral code, and after reviewing the proposals he continues :—

> Granted, if you will, that these proposals will attain the desired end—namely, an improved civilised existence for the worker—how is it to be brought about "without the crutches of a protective tariff" and "beyond all economic laws"? The proposals he makes in fact not only involve State intervention, but the establishment of a high standard of wages. Now, however pleased an employer may be to agree to the payment of high wages he has to sell his goods on the world's market or on the home market in face of the competition of other countries. The British manufacturer's article has to bear trade union prices, or in Mr. Hichens's scheme, prices fixed by the State Joint Industrial Councils, and contribute to a widely extended unemployment insurance benefit, and his men are to work eight hours or less per day. The foreign article may come from a country where there is no trade union, or if there is one, where the standard of wages is not nearly so high and where the State has not interfered in the beneficent way Mr. Hichens suggests. To be able to meet this foreign competition we are to have drastic economies in production and increase of production. No strikes, no indifferent workmanship, up-to-date machinery, cheap transport, &c. But all this is open to the foreigner to adopt without the additional highly protected labour and State exactions. It seems to me if labour is to be protected it should be done by an International Trades Union. Failing this, then the article produced by unprotected labour will knock out the protected article. An increasingly protected labour and free imports cannot surely meet the case, and in fact the one is a contradiction of the other. By all means let the light in on all dark places, as Mr. Hichens suggests, but is his scheme practical, and will it bring about the desired result with which one must sympathise?

Prof. Kirkaldy has been addressing the Birmingham Business Club on the subject, "The Industrial Position After the War." As reported in the *Birmingham Daily Post*, Prof. Kirkaldy said—

> When war broke out, the industrial position was that we were working in a vicious circle. He deprecated class war, and urged that employers and workmen should work together. Instead of looking at the wages book the employer should look at labour cost. It did not matter if a man took home £5 or £10 a week so long as the labour cost was low; most employers knew that low-paid labour was expensive labour—it was the best-paid labour that led to the least labour cost. When war broke out there was an industrial force of men and women in this country of over eight millions. Women came in to help to the extent of half a million, and the three factors which had produced the miracle of the increased supplies were, first, the patriotism of the men and women who had come forward; secondly, the scrapping of old methods and machinery, and the installation of the latest methods and newest types of machinery; and, thirdly, the Trade Unions allowing for the period of the war the machinery to be worked to its utmost capacity, members and non-members to work for all they were worth, and the cessation of a policy of a restriction of output. When peace came there would be big competition in the world markets. It would come not only from our present enemies, but naturally and necessarily from other nations. Business men must be prepared to face the future, gauge it, and take measures to meet it. He was optimistic enough to think that if all classes acted together there would be no need of facing smaller wages and less money among the community. When war ended our industrial equipment would be vastly improved compared with pre-war days. Owing to the devastation in France, Belgium, and Poland, the only European countries that would be in a position seriously to compete in the world markets would be England and Germany. The first attempt of whatever Government was in power in Germany would be to reconstitute the commerce and industry of the country. The Government would give every facility to import and export business, give bounties, flood the world with commercial travellers, tell the people that if they did not work for low wages they would have to starve, and tell the employers that if they would only work for a bare margin of profit they would be prosperous again in a few years. Were we going to indulge in class warfare and say there was to be a six-hour day and £5 a week, and were the employers going to stick to their luxuries and carry on the policy adopted before the war in respect to labour? He did not believe it. After the awakening of the last three-and-a-half years he could not believe there would be any going back. The demand for manufactures would be greater than anyone had any conception of. There were three thousand million people in the world whose needs had been held up for three-and-a-half years, and those needs must be satisfied sooner or later. It would be a long job, and there would be need for every man and woman able to work. It was said by some people there would be too much labour when the men returned from the war. Why, for a long time there would not be half enough to meet the policy of reconstruction and reaccumulation that had to be accomplished. To ensure success and good feeling between employers and employed there must be working agreements. Neither the organisations of the employers nor those of the men were perfect. They required developing and improving, especially the organisations of the employers. Provided there were unrestricted output and employers did not seek in a selfish way to outbid each other, there might be a new era of greater prosperity than had been known before with higher wages better conditions of working, better profits, and a better return on capital.

(*To be continued.*)

Electrical Standards in Australia.—Committees in New South Wales and Victoria have been nominated by the Commonwealth Bureau of Science and Industry and the Electrical Association of Australia conjointly for the purpose of investigating the subject of standardisation of electrical machinery, appliances and accessories.—*Commonwealth Engineer.*

ELECTRIC PLOUGHING.*

(Concluded from page 129.)

The Fillet Equipment.—Whilst German engineers have sought deliberately for heavy construction to give the desired stability in haulage and anchor gear, the French engineer, M. Fillet, has adopted exactly the opposite policy. The Fillet tackle is very light, and it secures sufficient stability by the rational method of pushing a special "spade" into the ground so as to offer more ground resistance to displacement of the haulage truck than has to be overcome at the plough. The complete truck (fig. 6) weighs less than 4 tons if provided with a 45-H.P. motor, and less than 6 tons if fitted with a 60-80-H.P. motor. The 4-ton model yields as high a tractive effort (8,800 lb.) as the Siemens gear which weighs more than three times as much. The driving motor is geared to the windlass and also serves to propel the truck either by chain drive on to the rear wheels (fig. 6) or by hauling on a small cable anchored about 200 yd. ahead.

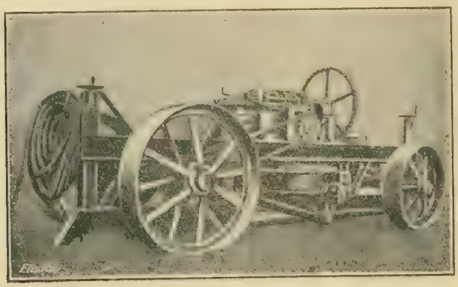

FIG. 6.—FILLET HAULAGE CAR WITH ANCHOR SPADE.

An "anchor spade," consisting of a steel plate 13 or 15 ft. in length and about 10 in. deep, is carried by four posts running in slides. By means of two handwheels the plate is driven down into the soil; thereafter it cuts its own way through the soil as the truck advances, a coulter being provided in front of the plate. The anchorage thus secured is so effective that a tractive effort of 57,200 lb. can be exerted by a haulage truck which weighs only 8,800 lb. complete with chassis, motor and control gear.

Sometimes it is possible to dispense with the longitudinal spade-anchor by fitting radial plates and checks to the wheels of the carriage. Such plates must be removed before the car can be used on an ordinary road, hence it is preferable to use plain wheel rims and an independent spade-anchor.

The Jeumont Equipment.—This was not designed for general sale, but for supply to a subsidiary company, the Soc. Generale Agricole. Owing to the war, there has not yet been opportunity to make prolonged tests, but there is good reason to believe that the Jeumont tackle will maintain the reputation of its constructors. All that can be said at present is that it is a heavy model (in the same category as the Siemens equipment) weighing 13 tons and exerting 8,800 lb. tractive effort. It is provided with an 80-H.P. motor.

Choice of Equipment.—The inherent advantages of a light equipment (such as the Fillet tackle) in point of cheapness and convenience are obvious. The only question is whether anchoring can replace dead weight in securing sufficient resistance to the pull which one wishes to exert in the plough-cable. Siemens and Jeumont depend on dead weight. Fillet argues that as it is earth resistance which has to be overcome (at the plough), it is a simple matter to provide greater earth resistance for anchoring purposes at the haulage truck. If the soil be loose and yielding the decreased hold of the spade-anchor is counterbalanced by the lower resistance to be overcome at the plough. If the buried surface of the spade-anchor at right angles to the pull of the cable be equal to the sectional area of the furrows ploughed, we have the whole weight of the haulage truck as margin of safety in the anchorage.

When ploughing 13 in. deep with a 3-share plough covering a breadth of 3 ft., the sectional area ploughed is $3\times13/12=3.25$ sq. ft. A 13-ft. anchor-spade driven in to its full depth of 10 in. gives an anchorage of $13\times10/12=10.8$ sq. ft., *i.e.*, the anchor alone offers more than three times the earth resistance of the section ploughed, quite apart from the dead weight of the tackle. This margin should be ample to provide for the traction of the plough frame and cable. There certainly seems to be no difficulty in securing sufficient stability in an anchored light-weight equipment, and in that case the fate of heavy-weight equipment is sealed, for there is nothing to compensate for its cost and inconvenience.

Distribution Problems.—Probably the principal reason why electrical equipment has not been used more extensively for ploughing (and other field operations) lies in the difficulty of carrying electrical energy safely and economically to the motor. The broad problem of providing overland transmission lines through agricultural districts is sufficiently important, but need not be discussed at present. Given such main transmission lines, there is no technical difficulty in providing a network of aerial distribution lines, working at high pressure, but probably considerably lower than the main transmission pressure, say at 2,500 or 3,000 volts compared with 10,000 or 15,000 on the main line. The real problem lies in connecting the ploughing motor to the local distributing line. A motor of 50, 60, or even 80 H.P. cannot be supplied economically at lower than 500 or 600 volts, even over short distances. Such a working pressure is unobjectionable (it is no higher than is commonly used for tramcars), but it cannot be used economically for any considerable distance. A high-tension distribution line must be run across or alongside the fields, and provision must be made for connecting to this through a portable step-down transformer. Connection to the high-tension line must be effective, and one must be able to make it safely and quickly at any one of a number of tapping points which are reasonably close together. Reduced to its simplest terms and smallest dimensions, the problem is to make "flying contact" with a high-tension line without risking electrocution of unskilled workmen. The high-tension tapping leads must be taken into the transformer cabin, again without risk of short-circuiting or of shock to workpeople.

The Siemens system is to use three insulated tapping wires provided with ring terminals which are dropped, by means of an insulating rod, on to hooks mounted on insulators about 13 ft. above ground and connected to the line wires higher up on the same pole. The transformer car is placed so far from the pole that the tapping leads are reasonably taut and cannot touch each other. It is not an expensive matter to provide tapping hooks and insulators on every pole or on alternate poles, but the rings cannot make very good contact, and the system as a whole is crude and none too safe.

Delamarre recommends that the tapping connection should be completed through an aerial horn-gap interrupter so arranged that the leads can be neither connected nor disconnected unless the isolating switch is open. The additional cost would be more than counterbalanced by the enhanced safety of working and the actual amount of the extra cost would not be serious since the haulage may be 800 yd. or so on either side of the transformer car, so that only a few poles need be fitted with tapping terminals and switches.

The transformer car itself offers no particular difficulties, and Siemens has evolved a very satisfactory construction. The car is divided by a vertical cross partition, and a door is provided at each end. The high-tension section contains the transformer and circuit-breakers, whilst the low-tension section contains cartridge fuses, a suspended meter, a measuring transformer, low-tension terminals for the trailing cable, and possibly a drum for the latter. The complete car weighs 3 to 3½ tons, and is well sprung. It is arranged for horse traction, but has no driver's seat, hence there is no temptation to proceed at more than a walking pace.

The trailing cable may have three 25 sq. mm. cores and be in lengths of about 300 yd., joined together by male and female connectors, but its life is greatly prolonged if it be carried clear of the ground. Abrasion is then reduced, and there is little risk of running over the cable with the vehicles. Fillet uses two types of support; one consists of an iron tube with a helicoidal thread to screw into the ground, and a horizontal cross-arm with three insulators for the cables (fig. 7); the other consists of two iron tubes fitted together to form an X, and carrying between its upper limbs a horizontal bar for the cables to rest upon. The T-carrier is useful in light soils, but the X-carrier generally permits of speedier erection. It is claimed that the cable can be placed on X-supports at the rate of ½ mile in 2½ to 3½ hours, which rate, we should think, could be ex-

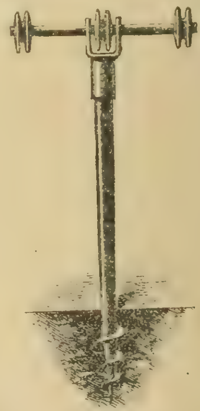

FIG. 7.—FILLET CABLE CARRIER.

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* Based on data given by M. Delamarre in the *Revue Générale de l'Électricité.*

ceeded. While the best method of carrying the flexible cable between transformer car and haulage motor is an important detail, it is not one which affects the major problems of electric ploughing.

Cost of Ploughing.—Electric ploughing can hardly be said to offer such definite advantages over other systems as the electric motor offers in comparison with other driving systems in general industrial service. In the present connection the ultimate criterion is the cost of ploughing. If electric ploughing shows a substantial saving, the system will sooner or later come into general use, and in the meantime its advocates have the best of all arguments in favour of its adoption. Without that argument it would be almost hopeless to assail the conservatism of farmers, but, fortunately, a good economic case can be made out for electric ploughing under reasonable conditions of co-operative service.

The cost of ploughing with horses or oxen varies from 24s. to 40s. per acre, generally approaching the higher figure. The mechanical systems which we may compare are steam ploughing (with a pair of haulages), petrol tractor ploughing, and electric ploughing. In each case prices will be reckoned on a pre-war basis, and on the assumption that the ploughing equipment is utilised for 10 hours per diem during all the season when ploughing is practicable. If this condition be not fulfilled—and it cannot be unless small farmers agree to co-operate—the fixed costs per acre become prohibitive.

Steam Ploughing.—Two portable engines, each driving a haulage gear, are used in this system. Each machine weighs 12 to 20 tons, and develops 75 to 125 H.P. The coal consumption varies from 6½ to 7½ lb. per H.P.-hour, and it is an open question whether its reduction by superheating justifies the additional complication involved. The specific coal consumption is increased materially by the fact that only one machine is working at any moment, whilst the fuel consumption of the other is practically as great as though it were working as well. Under favourable conditions, one can reckon upon a fuel consumption of 445 to 490 lb. per acre when ploughing 10 acres a day to a depth of 12-14 in.; the consumption falls to about 270 lb. per acre for 20 acres a day ploughed 7 or 8 in. deep. Four men and a mechanic are needed to operate the equipment and keep it in order, and labour has to be provided for carting 1½ to 1¾ tons of coal and 650 gallons of water per 10-hour day. The first cost of the equipment is between £3,000 and £4,000, on which one must allow 5 per cent. interest, and 10 per cent. for depreciation, maintenance, repairs, &c., (including the haulage rope).

On this basis, the *cost per acre* for ploughing 1,240 acres per annum (10 acres per day) to a depth of 12 or 14 in. is as follows:—Fixed charges 9s. 7d., coal (at 32s. per ton) 6s. 5d., transport of coal and water to field 2s. 5d., oil, grease, &c., 1s., wages 3s. 4d.; total 22s. 9d. This agrees well with the cost price to the Soc. de Labourage à Vapour du Soissonnais of 18s. per acre, on the basis of 1,730 acres per annum, and leaving coal and water transport to the farmer.

Tractor Ploughing.—M. A. de Poncins (president of the Syndicate de Culture Mechanique de l'Union du Sud Est) has made practical tests on his farms with a petrol tractor and a special three-share plough, cutting 3 ft. wide and 7 or 8 in. deep in heavy soil. The area ploughed was 5 acres per day, which seems a poor performance, but corresponds to working at 3 M.P.H. for 10 hours per day, and losing about 50 per cent. of the time in turning at each end of the furrow. (Turning represents a very serious item when ploughing short furrows by tractor.)

Allowing for a tractive effort of 1,230 lb. per sq. ft. in heavy soil, the power required is, theoretically, 14½ H.P., or to allow for losses in transmission, &c., say, 20 H.P. The corresponding fuel consumption would be about 4½ gallons of petrol per acre.

This equipment costs about £475, which amount may be written off in four years; allowing £35 per annum for repairs, and assuming that petrol costs 1s. 9d. a gallon, and that 620 acres a year represents the maximum performance of such a plough (10 hours a day for five months), the costs per acre are:—Depreciation 3s. 10d., repairs 1s. 2d., wages 1s. 7d., interest, insurance, general expenses, &c., 2s. 4d., petrol 8s., oil, grease, &c., 1s.; total, 18s. per acre.

Electric Ploughing.—An electrically-driven haulage is capable of doing as much work as a steam-driven set, viz., 1,240 acres per annum (10 acres per day), ploughed 12-14 in. deep; or 2,470 acres per annum (20 acres per day), ploughed 7-8 in. deep. The consumption of electrical energy is 28 to 30 units per acre in the former case, and 20 to 22½ units per acre for the shallower ploughing. The cost of the equipment (on a pre-war basis) is about £4,000 for a 750-850-acre farm. Including the necessary fixed high-tension lines, the cost amounts to £6,200 for a 1,240-acre farm, and £7,000 for a 2,470-acre farm. Five per cent. each may be allowed for interest, depreciation, and maintenance. A man is required at each haulage gear, and one should be an electrician; in addition, there must be a man at the plough and a boy as helper, bringing the total wage bill up to £1 a day.

On this basis the charge for interest, depreciation, and maintenance comes to 12s. per acre, and for wages 2s. per acre, *i.e.*, 14s. total for these items when ploughing 12-14 in. deep, and 9s. 6d. per acre when ploughing 7-8 in. deep. In order to arrive at the complete cost per acre we must add the cost of, say, 30 KW.-hours per acre for deep ploughing, and 22½ KW.-hours for ordinary ploughing. With the energy at 1d. a unit the total cost of electric haulage ploughing is 16s. 6d. an acre, 12 to 14 in. deep, and 11s. 4d. an acre, 7 to 8 in. deep.

Conclusions.—The above results are summarised in Table I, from which it will be seen that electric ploughing has a good margin of economy over the competing systems. In preparing the present estimates it is assumed that the equipment is utilised fully during the ploughing season, and that all fixed charges are allocated to the ploughing service rendered. Fixed charges represent a large proportion of the total cost of machine ploughing, particularly in the case of electrical operation, and it follows from this:—(*a*) That it is very important to make full use of the equipment during the ploughing season, using it on several adjacent farms if necessary to make up a total acreage of, say, 1,250 acres for deep ploughing, or 2,500 acres for ordinary ploughing; (*b*) that if the haulage be used for other cultural purposes (*e.g.*, harrowing, rolling, scarifying), as it certainly would be in practice, the whole of the fixed charges do not fall on the ploughing, so that the actual cost of the latter is reduced, and to a greater extent the higher the proportion of capital to other charges.

Table I.—Cost of Ploughing by Various Systems.

System.	Deep ploughing (12 to 14 in.) per acre. s. d.	Ordinary ploughing (7 to 8 in.) per acre. s. d.
Steam haulage	22 9	12 10
Petrol tractor		18 0
Electric haulage, with energy at :—		
¾d. per unit	15 10½	10 11
1d. "	16 6	11 1½
1½d. "	17 9	12 4
2d. "	19 0	13 3

Note.—It is assumed that the ploughing tackle is used 10 hours a day during the whole ploughing season. This corresponds to 1,240 acres per annum for deep ploughing by haulage, or 2,470 acres per annum for ordinary ploughing, and to 620 acres per annum for tractor ploughing 7 or 8 in. deep.

Tractor ploughing is the most costly of the three systems considered, but there are several reasons why it is a dangerous competitor to electric ploughing:—(1) Tractors may be used anywhere, and at practically the same cost for fuel, in remote districts as in the neighbourhood of large towns; (2) the first cost of tractor ploughs is relatively very low; all difficulties, inconveniences, and risks associated with the erection and utilisation of high-tension transmission lines are avoided; (3) tractors are very useful to farmers for general haulage purposes; (4) the maximum ploughing capacity of a tractor is about 600 acres per annum, whereas an electric (or steam) haulage plough can deal with more than four times this acreage under similar conditions, and must be used either co-operatively or on a very large farm in order to show a low cost per acre.

Tractors pander to the egoism of farmers. *Electric ploughing is the cheapest system, but must be applied to a large acreage,* and therefore necessitates co-operation between small farmers. Deep ploughing is not advisable where immediate returns are desired from land which has a sour, unworked subsoil, but in well-cultivated districts from 20 to 35 per cent. heavier crops are obtainable by deep ploughing, and the latter can be effected electrically at about 30 per cent. less cost than by the steam haulage system.

The onus of conducting propaganda in favour of electric ploughing lies upon the central stations. The general trend of development in electricity supply is towards overland transmission and interconnection of existing supply networks. This will provide main arteries which are desirable from general considerations of economy in generation and distribution, and which will form the ground work of an ever-extending network for rural electricity supply. The farmer who contemplates "electrification" will wish to apply electrical energy to all his power requirements, high amongst which rank ploughing and other operations of tillage. The central-station engineer will be equally anxious that such important loads be added to his overland mains.

There is no difficulty in making suitable electrical equipment for every agricultural purpose, and manufacturers will necessarily meet the demand directly it arises. The main issue is between farmer and central station, and it is up to the central-station engineer to prove to the farmer that the considerable first cost of electric ploughing equipment is well invested. A private generating plant on the farm itself is economically hopeless save in quite special cases. The farmer must depend on overland supply from a large central station, and it is no less than the duty of every central station—in its own interests, in the interests of agriculture, and in the interests of fuel economy—to provide rural distribution lines, to bring home to the farmer the economic possibilities of electricity in agriculture, and to assist financially or otherwise in the organisation of such co-operative schemes as are essential to complete realisation of these possibilities.

The Omnium Francais d'Electricite has established a scheme for co-operative electric ploughing in the Meaux district. Which will be the first British station to follow suit? The successful central station of the future will not be the one which confines itself to selling whatever energy is demanded at so much a unit, but that concern which sends its emissaries to investigate the consumer's problems, and applies its whole powers and resources (on a sound business basis) to overcoming his difficulties.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The 12½ per Cent. Award and Clerical Staffs.

May I through your esteemed columns draw attention to an injustice to which a large number of your regular readers namely, the clerical sections of the technical staffs of the generating stations throughout the kingdom—are unintentionally liable to be subjected at the present time through interpretation, or, rather, restricted interpretation, of the word "technical" as employed in the award.

I think I am expressing the convictions not only of the whole of the clerical staffs concerned, but also of a large number of the chief engineers themselves, when I submit that Sir George Askwith intended this word to be interpreted in its broad sense, and thereby to include not only the engineering but the clerical branches of the technical organisation of the undertakings referred to, as it is needless to point out that the latter branch is an integral portion of such organisation.

There is, however, from our point of view, a danger of diversity of interpretation as between one undertaking and another, by reason of the obscurity enveloping the words "technical staff" given in Sir George Askwith's award, and consequently injustice is likely to be inflicted upon a large number of clerical staffs through possible misunderstanding of its broad application (in many cases it may be through no lack of appreciation of the staffs by the engineer and manager, but through an unintentionally mistaken distinction between the functions and relative importance to the undertaking of the engineering and the clerical sides, to the prejudice of the latter), the essential fact being overlooked that an electricity works technical staff must comprise not only the engineering but the concomitant clerical section of the complete works organisation.

It need scarcely be mentioned that the clerical staffs, as a whole (amongst whom are many highly competent men belonging by virtue of examination to professional organisations relating to their craft, just as do the engineers), are amongst the most wholeheartedly and consistently loyal and capable assistants of the engineer and manager, and of his subordinate engineers; but though he is the first to acknowledge this fact, his desire for their due recognition by others is occasionally liable to be over-ruled.

In the name, therefore, of the large and essential body of your readers constituting the staffs in question, I venture to appeal to you to exert your valuable influence on their behalf to obtain from Sir George Askwith himself his definite ruling that the clerical sections of the technical management of electricity generating works are with in the scope of the word "technical," as employed by him in his award.

This ruling would settle the question finally, and would appear to be necessary, as it is neither just nor desirable that each undertaking should be left with the option of placing its own construction upon a Minister's award, the purpose of which is strict uniformity of application.

You will, of course, be aware that the Bristol Electricity Committee and Mr. H. F. Proctor, their engineer, have given the word "technical" its broad interpretation by applying the award to "all employés of the department (both sexes), whether engaged on generation, distribution, office work, or management, or otherwise, who are in receipt of a net wage or salary not exceeding £250 per annum.

If you could, therefore, obtain Sir George Askwith's pronouncement to the effect that the interpretation of the Bristol department is correct, and that all undertakings must act in accordance therewith, you would not only remove the existing anomaly, but render a lasting service to the whole of the clerical members of the works organisations.

Apologising for the length of this letter, and assuring you of our keen appreciation of any steps you may be good enough to take in the matter on our behalf—

Chief Clerk.

[Our correspondent, and the section for which he speaks, have our hearty sympathy. They are as hard hit by the high cost of living as the technical members of the staff, and, in our opinion, are equally entitled to participate in the award. The policy adopted by the Bristol Electricity Committee was mentioned in our issue of February 1st, and we commend it to the notice of other Committees as an excellent example to follow, although, as then reported, in one of Mr. H. F. Proctor's replies to members of the I.M.E.A., he stated that not all the clerical staff were necessarily included under the award. It is really, however, a matter for justice, not meticulous discrimination.

As regards the issue of a further pronouncement by Sir George Askwith, we do not think it probable that he would take this course; the normal procedure is to apply for the award, and if it is not granted by the employer, to appeal to the Chief Commissioner, who decides each case on its merits; but he will not act until an actual difference of opinion has arisen.—EDS. ELEC. REV.]

Examinations in "Electrical Installation Work."

I wish to endorse the remarks of Messrs. A. P. Lundberg and Sons regarding the cancellation of the examination in "Electrical Installation Work" by the City and Guilds authorities because we are at war. No reasonable excuse can be offered in support of such action, which discriminates in a biased manner between competitive industries and deliberately side-tracks the efforts of the Electrical Contractors' Association.

Messrs. Lundberg were not alone in thinking that classes in electrical installation work were inadequately equipped. The E.C.A. realised this long ago, and last July sent a deputation to express their views before the Higher Education Sub-Committee of the L.C.C., anticipating that if this body received them favourably their example would spread throughout the country with good results. The deputation asked for a voice in the selection of teachers (for the subjects studied by their apprentices), better equipment, and more efficient inspection. After three months had elapsed a letter arrived, stating that none of our requirements would be granted, but that the Committee would be pleased to consider suggestions. My suggestion is that the Committee be put on the scrap-heap. They are like most so-called education authorities—entirely out of touch with industry—and while they hold the reins we shall remain handicapped.

Another contributory cause of the poor equipment in practical classes is that many principals of technical schools and polytechnics have no practical knowledge. They are mostly chemists or physicists, and do not recognise the needs of the workshops.

My personal experience is that this session has produced record attendances at a certain polytechnic in the practical classes of electrical installation work, and the ages range from 15 to 62 years, including men of military age who are exempt for various reasons.

W. Ellerd-Styles.

London, E.C. 1, *February 11th*, 1918.

Depreciation.

A question has arisen with the X Electric Supply Co., Ltd., as to the rate of depreciation of the various assets of the company, and what sum should be carried to a depreciation account each year so that the value of the assets may be preserved, and a fund accumulated out of which any assets that are worn out, or become obsolete, can be renewed. The directors of the company are not unanimous as to the percentage of capital value which should be carried each year to the depreciation fund, and would like the benefit of the views of some of your readers as to what percentage on the capital value of each of the following classes of assets it is reasonably necessary either to carry to a depreciation fund each year or, alternatively, to write off the value of the assets:—(1) Buildings; (2) mains, mostly laid naked; (3) gas producers and engines; (4) machinery and plant, other than accumulators; (5) accumulators; (6) meters.

Subscribers.

A PROPOSED ASSOCIATION OF ELECTRIC POWER STATION ENGINEERS.

THE movement towards forming an institution or association, the membership of which, it is proposed, shall include all members of the technical staffs engaged in electric power stations in the United Kingdom, from chief engineers to junior technical assistants, has progressed a further stage towards its successful launching.

A preliminary conference has been held in London between representatives of the Associated Municipal Electrical Engineers, Chief Technical Assistants' Association, and the Association of Electrical Station Engineers.

Mr. L. L. ROBINSON, of Hackney, presided, and it was decided that a temporary executive committee should be appointed to draft the rules and constitution.

Included in the committee that was appointed were the honorary secretaries of the associations present, and an invitation was sent to the honorary secretaries of the Incorporated Municipal Electrical Association, and the Companies' Conference, asking them to give their support and assistance. At the same time, it was thought most desirable that though, for the sake of convenience of meeting, the London Associations are in the early stages taking the initiative, the support of the officers of the undertakings in the United Kingdom should be obtained, and the Committee request that communications from individuals or the secretaries of existing associations not yet represented, as to support or suggestions, should be forwarded to the respective honorary secretaries of the London Associations referred to, or the honorary secretary of the Executive Committee, Mr. MacAlister. A further meeting will be held in March, notice of which will be sent to those who express their desire to be present.

Previous attempts have been made to form such an Association, but at all times the obstacles to success have appeared so great, and the interests of the various grades of technical officers so divergent, that the promoters have despaired, and have abandoned the project; but having now got existing associations embracing all grades of officers interested and represented on the preliminary Executive Committee, the Committee believes that the obstacles and difficulties should be capable of being overcome, and if it is given the support which is necessary, ultimate success will be assured.

Executive Committee.—The Hon. Secretaries of the Assoated Municipal Electrical Engineers (Greater London), hief Technical Assistants' Association, and the Association Electrical Station Engineers, together with Messrs. Napier ad Healey. It is hoped that the Hon. Secretaries of the Incororated Municipal Electrical Association and of the Conference Companies will accept the invitation to join the Executive ommittee.

In this connection, the following letter has been received om Mr. A. P. MacAlister (Electricity Works, 50, Eden rove, London, N.), hon. secretary of the Chief Technical ssistants' Association :—

My Association, at their meeting held on February 2nd, onsidered the question of the formation of an Institute or ssociation of Electrical Power Station Engineers, and, with view of affording material assistance towards this end—aving considered that it would not probably be the intenion of the promoters to interfere in any way with any of he existing technical associations, which comprise various rades of officers in electric power stations, but that, probably the early stages of forming the institution or association, he assistance of these existing associations would materially ssist in forming the proposed new institute or association—he Chief Technical Assistants' Association, which includes he following* grades of officers in the Greater London area, re for the time being extending the invitation to municipal fficers holding similar posts throughout the country, thus btaining their support in the first instance by joining this ssociation, and as soon as sufficient members were obtained, o form local sections on similar lines to that which is now eld in London. The London members would do their utmost o assist other sections, and if all who are interested will ommunicate with the Hon. Secretary, he will be pleased to ut forward their name for election, and also to receive any iews or suggestions which they might have as to forming ocal centres, and also in respect of the proposed new instiute or association.

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* *Grades of Officers included in the Chief Technical ssistants' Association.*—Deputy electrical engineers and chief ssistants, resident engineers, mains superintendents, station uperintendents.

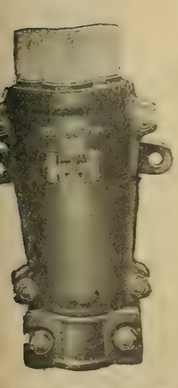
[We refer to this matter in our leading columns to-day — Eds. Elec. Rev.]

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Vertical Terminal Box.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, E.C. 2, have introduced a new type of vertical terminal box, specially designed to facilitate jointing. Fig. 1 shows an indoor wall type for 3-core cable, low pressure, and fig. 2 is a part vertical section of a twin-cable box, showing the components. The method of jointing is as follaws :—



g. 1.—Vertical Terminal Box for 3-core Cable.

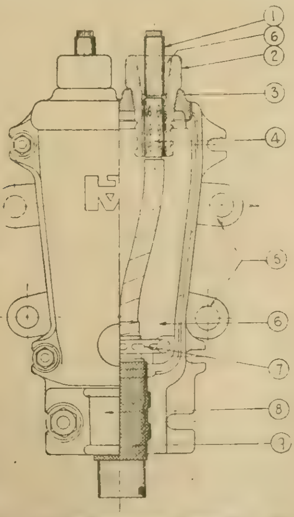


Fig. 2.—Low-pressure Terminal Box

1, V.I.R. tail; 2, porcelain insulator; 3, cast-iron top; 4, tinned brass connector; 5, lugs for wall fixing; 6, space filled with compound; 7, tinned copper earthing strip; 8, cast-iron cable grip; 9, compounded canvas wrapping.

The back half of the box is first bolted to its support in the required position, and the cable marked off and telescoped in the usual way. Porcelains (2) and C.I. top (3) are slipped up the tails clear of the joint. The brass connectors (4) are placed over the strand of the cable and of the tails, and the grubscrews are then tightened up. Solder holes are provided in the connectors, in order that the joints may now be soldered, although this is not necessary. The tinned copper earthing strip (7) is removed from the box and given a turn round the lead covering of the cable and soldered, care first being taken to scrape the lead sheath bright under the copper tape. The cable, over the outer serving, is next bound tightly with the compounded canvas band (9), each turn of which should be warmed by a blow-lamp to assure adhesion between layers, until the diameter of the cable is slightly more than the maximum diameter of the grip (8); then each edge of the canvas is bound with a turn of iron wire. The completed joint is then inserted into the back half of the box, and the cable grip (8) bolted down on the warm canvas bedding. The earthing strip is fixed to the box by the screw provided, the C.I. top, with the insulators, is lowered into place, and the front of the box is bolted up. The box is now ready for filling with the insulating compound, which is poured in through a hole in the cover by raising an insulator clear of the cover. After filling, the insulator is replaced, and the tapered recess in each insulator top filled with compound. Each box is supplied complete with all the necessary jointing material, with the exception of solder and compound.

Automatic Elevator for Shells.

The automatic elevator illustrated in the accompanying figure has been recently designed and erected by Messrs. Ed. Bennis & Co., Ltd., of Little Hulton, near Bolton. It is arranged both to elevate shells or similar cylindrical bodies from a lower to a higher level, and to lower them, and can perform these operations simultaneously. A feature of the appliance lies in the fact that the articles do not pass round the top or bottom drums either when being raised or lowered, the feeding and discharging in each case taking place on the same side of the elevator.

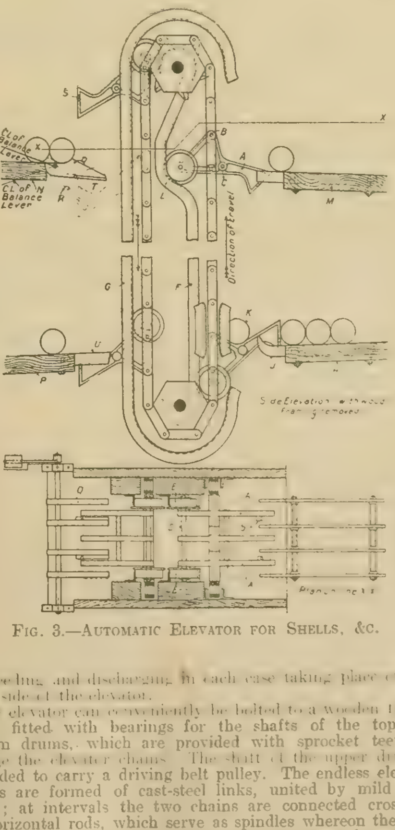


Fig. 3.—Automatic Elevator for Shells, &c.

The elevator can conveniently be bolted to a wooden framework, fitted with bearings for the shafts of the top and bottom drums, which are provided with sprocket teeth to engage the elevator chains. The shaft of the upper drum is extended to carry a driving belt pulley. The endless elevator chains are formed of cast-steel links, united by mild steel rivets; at intervals the two chains are connected crosswise by horizontal rods, which serve as spindles whereon the shell carriers are pivoted. The carriers are built up of cast-steel bossed plates A, pivoted on the cross spindle at B, riveted together at C, and joined by an axle at D. This axle does not rotate, but carries at each end a roller E, the body of which is hollow, and filled with lubricant. The rollers work against two pairs of mild steel angle-iron guides, F,G, fixed to the wooden framework.

The shells to be raised approach the elevator by rolling down a gently sloping table H, at the end of which upturned steel prongs J are fixed. The plates of the carrier passing between these prongs lift the lowest shell, which rolls into the position shown at K. On reaching the level at which the shells are to be discharged, the rollers of the carrier pass into bends L in the guides F. This causes the carrier to tip the shell on to the gently-sloping discharging table M, the end of which is provided with straight prongs.

Passing over the top sprocket drum the carrier, now upside down, is available for lowering shells from the level N to the level P. The table at N slopes gently towards the elevator, and at its end is provided with a group of pivoted and balanced prongs U. Two of these prongs are formed with projecting lips R, against which projections S on two of the plates of the carrier strike during the descent. The shell resting on the prongs Q is thus allowed to fall into the hollow on the back of the carrier, as at T, and is lowered thereon until it reaches the fixed straight prongs U on the end of the lower table P.

WAR ITEMS.

From "Over There."—An Inspector of Ordnance Machinery, writing from France, says:—"I am writing to express my thanks to you for sending the ELECTRICAL REVIEW to this unit so regularly. I am sure one is indebted for the prompt way it is sent. I have a fair number of mechanics with this unit, who are only too glad to get hold of any technical work so as to keep them a little bit posted up in affairs in the electrical world, apart from the interest it has for myself. I have been out here now for close on 30 months, so one feels that one is cut off from commercial, scientific, and technical circles, although our work is probably the highest mechanical type of engineering that is being undertaken. Of course, regulations prevent one from writing what might be very interesting reading."

Restrictions on Retail Trading.—Under a new Defence of the Realm Regulation, the Director of National Service may prohibit or restrict persons from establishing any new retail trade or business, or a new branch of any existing retail trade or business, without licence. The object of this is that the best use shall be made of all persons able to work in any industry, occupation, or service.

Aliens and National Service.—The "London Gazette" for February 8th contains the full Order as to restrictions that are to be imposed on aliens of 18 to 61 by the Director-General of National Service. A list is given of trades and industries in which they may not be engaged without the Director's permission. These include the manufacture of gas and electric light fittings.

Russian Electrical Works Confiscated.—Owing to the refusal of the proprietors to obey the Decree handing over the management of business concerns to the workmen, the works of the Petrograd Electrical Armament Co. have been confiscated by the Council of People's Commissioners.—*Times*.

Excess Profits on Magneto Manufacture.—The British Ignition Apparatus Association, Ltd., applied for an increase of the statutory percentage as respects the business of manufacturing magnetos used for ignition purposes in connection with internal-combustion engines. The Board of Referees has now ordered that in the case of trade or business carried on or owned by a company or other body corporate the percentage shall be increased to 11 per cent.

Exports to China.—The "London Gazette" for February 12th contains a further list of bodies and persons in China to whom exports may be consigned.

The 1886 Company Confiscated by Bolsheviks. By a Decree of the Council of the People's Commissioners, all the property of the General (1886) Electric Lighting Co. is confiscated, no matter of what it may consist. The confiscation, according to the Decree, takes place because the company, whilst receiving subsidies for many years from the Government, has been brought by the management to complete financial ruin, and into conflict with the employés, threatening the complete closing down of the business. The Decree requires that all the employés, including the technical staff, shall remain at their posts and continue their work. For unauthorised absence from duty, or sabotage, the guilty will be brought before the revolutionary courts.

Canadian War Measures.—Canada's new War Trade Board will investigate and keep a record of the country's stock of raw materials and make recommendations for the maintenance of the more essential industries, and will also consider methods for curtailing or prohibiting the use of fuel and electrical energy.—*Times*.

Raw Materials After the War.—Speaking in the French Senate last week, M. Clementel, the Minister of Commerce, said that as to the question of raw materials, which were indispensable for the industries of all countries, and especially of Germany, an organisation which would assure agreement between the Allied Powers on the subject was necessary, and from this point of view he emphasised the importance of the entry into the war of the United States, the most powerful among the nations in regard to raw material, and owing to which the Allies had now a redoubled weapon at their disposal against their adversaries. "Germany, more than any other country, is dependent on foreign countries for raw materials and food-stuffs. We do not dream of creating an aggressive economic league, but we desire to remain masters of our own markets, and to reserve our raw materials for ourselves, our Allies, and friendly neutrals. If we close our ports to Germany it will have been her own fault. We wish for a peace durable, fruitful, and beneficial for humanity."

The Senate then voted:—"The Senate, in view of the fact that the Allies have at their disposal in the form of raw materials an economic weapon of the first importance, particularly feared by the enemy, urges the Government to seek, by the centralisation of economic efforts in France and in the Entente countries, the means of deriving the utmost benefit from these resources which are coveted by the Central Empires for the re-establishment of their industries."

Exemption Applications.—At Woking, the Tribunal has given an exemption certificate in exchange for his protection certificate to A. J. Jamieson (31, Grade 1), meter tester for the Electric Supply Co.

At Oxford, the Electric Tramway Co. applied for further exemption for M. F. Sadler (33, Grade 2), unit adjuster, and T. Walker (39, Grade 1) and C. W. Millard (37, Grade 2), drivers. Mr. A. A. Tyler, general manager, said that they were as short in labour as ever they were, and were constantly trying to obtain fresh men. Captain Shield asked if the Grade 1 man could not be replaced, and Mr. Tyler said: "Don't you think you could send us someone to replace him?" Captain Shield: That is not our job. We create the gaps, and you fill them. Don't you think you could make more use of the inspectors as drivers? Mr. Tyler replied that with all their willingness, the men were only capable of doing one man's work. He added that it was impossible to do without the three men. At Bristol, the Tramway Co. were allowed to retain 450 out of 487 men when there was a comb-out, and he thought the same favour should be shown to Oxford. Millard and Sadler were exempted for three months, and Walker was given two months before reporting for service.

Maidstone Tribunal has granted six months' exemption to E. J. Freed (41, C 2), driver and inspector on the Corporation tramways.

At Axbridge, a review was made of the case of E. Bond (33, A 1), electrical engineer, with the Wedmore Electric Supply & Power Co., whose conditional exemption had been varied to six months. Mr. W. G. Burrough said that Bond was the only one employed to look after the gas plant, dynamos, and batteries, and to do all the necessary repairs and renewals, and to repair breakdowns of the motors throughout the district. The company provided current for lighting and for power by farmers and others. Conditional exemption was granted whilst Bond is similarly employed.

The Spenborough Tribunal considered an appeal by the local Tramway Co. for exemption for a trolley head examiner and controller (31, Class A). Mr. F. D. Richmond (National Service Representative) said that he was instructed not to oppose the granting of exemption to the man, who was said to be holding a very responsible position at the depot, and the man was granted conditional exemption on remaining in his present position.

An appeal filed by J. J. G. Ewins, electrical engineer, of Exeter, who had been given a short final period of exemption by the local Tribunal, has been dismissed by the Devon Appeal Court.

At Dover, the National Service Representative had a review of the case of E. W. Wright (40, C 1), electrical engineer. Mr. Wright produced evidence of important maintenance work he had to carry out for munition firms, and four months' exemption was conceded.

Brighton Tribunal has granted three months' exemption to an electrician at a local theatre (35, C 3).

The Bucks. Appeal Court has allowed a Military appeal against exemption granted to F. G. Isgrove (18, B 1), electrician, of Windsor, and cancelled the certificate in force.

At Douglas (Isle of Man), exemption was sought for J. F. Hawley (35, C 2), electrician at the Aliens' Camp. The National Service Representative urged that the work could be done by a discharged soldier, or by a man who was medically unfit. It was stated that Hawley was the only Britisher in the electricity department, of which he was the superintendent, and they had had to put in three separate plants to prevent a breakdown. Mr. Joseph Cunningham, head of the department, said that he could get aliens qualified for this work by the score, but he was told that it was most important that aliens should not be near the electrical installation. If the Military authorities could provide a really efficient substitute, he had no desire to keep this particular man. Conditional exemption was granted, with a re-hearing if the National Service representative offered a substitute.

Hereford City Tribunal has granted exemption until June 15th to E. Harding (41, B 3), manager of the electrical department of Messrs. Harding.

At Colchester, the Corporation Tramways manager (Mr. R. C. Bullough) appealed for five employés, four in Class A and the other in C 1. The National Service Representative said that it had been agreed that three of the Class A men were indispensable, and should be given conditional exemption, and that the other two should be called up on March 31st The Tribunal approved.

At Crewkerne, the headmaster of the Grammar School appealed for the retention of F. G. Cleall (18), who has entire charge of the engine used for the electric light plant, but exemption was refused.

At Rochdale Tribunal, W. Pickard (31, B 2) stated that he was engaged in research work in electrical engineering. He was working on behalf of a gentleman associated with an important firm, and he had great expectations from his experiments in the direction of getting a more efficient turbine, and in extracting a greater amount of heat from coal. The Chairman remarked that he seemed to be at the same stage of his experiments as when he was last before them, and the Tribunal ordered him to report for service on March 15th. The applicant said he would appeal to Manchester.

At Norwich Tribunal, H. B. F. Meachen, electric tramcar driver, sought exemption from military service on personal grounds. Aged 18 and placed in Grade 2, the applicant told the Tribunal that he was the support of his widowed mother. The Tribunal held that the mother would be no worse off if the son were in the Army, the Chairman observing that an application from a young man of 18, Grade 2, could not be entertained.

LEGAL.

Littleborough U.D.C. v. Victoria Dyeing, &c., Co., Ltd.

At the Manchester Chancery Court, on Friday, a case which should have come on for trial before the Vice-Chancellor, Sir Dudley Stewart Smith, K.C., was one in which the plaintiff Council claimed that an agreement made by them with the Victoria Dyeing, Raising & Finishing Co., Ltd., Littleborough, was in force and valid for the full term, or, alternatively, that they were entitled to repayment of a proportion of the capital expenditure incurred in connection with it.

By an agreement dated March 11th, 1915, the plaintiffs were to supply electricity to the defendants for a period of 10 years from April 1st, 1915. In laying down cables, &c., the plaintiffs spent £1,730. On September 26th, 1916, the mill was accidentally destroyed by fire, and the Ministry of Munitions would not grant permission to rebuild. Under these circumstances, the defendants contended that the destruction of the mill put an end to the agreement.

Dr. Atkinson, K.C. (with him Mr. Brocklehurst), said it was a most interesting case, and one in which it was reasonable the parties should meet. They had agreed to split the claim, and there would be judgment for the plaintiffs for £750 and costs, with liberty to remove the service cable, which was their property.

Mr. Grant, K.C., for the defendants, added that if any difficulty arose about the removal of the cable they were to pay the plaintiffs an additional £50. They had sold the land, and the owner might object to the removal.

Aldworth v. Smith.

At the Nottingham Assizes, last week, before Mr. Justice Horridge and a special jury, Mr. John Aldworth, manager of the Nottingham Corporation Tramways, brought an action against Mr. E. C. Smith, lithographic artist, of Bulwell, for libel contained in a series of letters to plaintiff, to Mr. R. H. Swain, chairman of the Tramways Committee, also to the Deputy-Mayor, the City Coroner, and others. The libels related to many points connected with the general tramway policy of the department. The case was heard in great detail, and ultimately a verdict of £20 damages was given in favour of the plaintiff.

BUSINESS NOTES.

The Dutch East Indian Market.—If the attention of British electrical firms should not be entirely absorbed in the future by other export markets, it might be worth while to devote some consideration to the possibility of opening up business with the Dutch East Indies, the large islands in which are capable of enormous development as a result of the gradual expansion of the constantly growing numbers of Dutch and native undertakings engaged in the production of sugar, rubber, and other articles, and the demand for improved methods of transport. Apart from the machinery required for the industries mentioned and for other branches, an inclination exists to substitute electric for steam traction in those cases where steam tramways are to be found, whilst the question of electric locomotion on railways finds approval in many circles, together with the electrical tranmission of power. The curious fact in connection with the Dutch East Indian Islands is that electrical machinery made in Holland does not enjoy in the East Indies as good a reputation as that which is attributed to plant constructed in Germany or Switzerland. It is not quite clear why engineers in the islands should take up this standpoint. It may be that German installations carried out in Holland have influenced them in the matter, or the Dutch engineers in the colony may have received their training in Germany or Switzerland. Whatever the reason may be there is no question that the preference exists for electrical machinery made outside of Holland. It is quite evident from this circumstance that the colonial engineers are unaware of the many failures of German-made machinery in different parts of the world, including China, during the past few years; and some day something may become known concerning failures of plant other than that made in Germany. At any rate, it is well to remember that the preference in question prevails in the Dutch East Indies, and it may possibly also extend to the Philippines. With the latter we may rest assured that the Government of the United States will deal, whilst the Dutch Home Government is quite capable of controlling the colonial administration in the Dutch East Indies. But this can scarcely be the case with the private undertakings, innumerable as they seem to be, which promise to provide a large amount of work for electrical engineers at some future period in the matter of tramways, light railways, lighting, and the transmission of power.

Auction Sale.—Messrs. Percy Huddleston & Co. will sell by auction at Hammersmith on Tuesday, February 26th, a quantity of electrical apparatus. Full particulars are given in our advertisement pages to-day.

Electrical Developments in Sweden.—A month ago the Swedish Board of Trade presented to the Financial Department a report relating to the activity of the mining and iron and steel industries during the year 1916. Dealing with the part played by electricity in the matter, and bearing in mind the now well-known efforts which are being put forth to develop the national industries, the report mentions that the production of electric pig-iron in 1916 experienced an increase of 9,707 tons, as compared with the preceding year, and amounted to 44,782 tons. The output, which is chiefly sold to other countries, is specially connected with Trollhattan, where two new smelting works have been established since the previous year. The largest plant is situated at the Vargons works, where, it is said, the greatest electric smelting furnace in the world is located.

The Stal och Maskin A.B. has been formed at Uppsala to take over the steel and engineering works of Sanner & Co. of the town, and to produce steel and castings by electricity.

The Elektrisk Träförädling A.B. has been constituted at Ockelbo to acquire the undertaking of the S. K. Bosagen with waterfall which is to be developed for the production of electrical energy and the electrical improvement (treatment) of wood.

The Svenska Allmäna Electricity Co. has just decided to increase the share capital from £1,813,000 to £2,747,000 by the issue of new shares at the price of 110 per cent., of which 5,000 are reserved for the Scandinavian Electricity Works Co.

Fire.—A fire took place, last week, at the works of Messrs. Chamberlain & Hookham, electricity meter manufacturers, New Bartholomew Street, Birmingham.

Book Notices.—Circular of the Bureau of Standards, (No. 66): "Standard Samples for Thermometric Fixed Points." Washington: Government Printing Office. Price 5 cents.—In this circular the Bureau of Standards announces that it is prepared to distribute samples of pure tin, zinc, aluminium, and copper for use in testing pyrometers used in measuring high temperatures. These metals melt at definite temperatures, and by using the pyrometer to observe the temperature at which the metal melts, it is possible to decide whether the pyrometer reads correctly. The accurate measurement of high temperatures has acquired an enormous importance in the metal-working industries; the standard temperature samples therefore supply standards which are of great value. Those interested may obtain a copy by addressing a request to the Bureau. The following are the values of the freezing points of the first lot of metals now being issued:—

Metal.	Freezing point °C.	Purity.
Tin	$231{\cdot}8_5$	99·988
Zinc	$419{\cdot}4_4$	99·993
Aluminium	$658{\cdot}6_5$	99·66
Copper...	1,083·0	99·987

An additicnal fixed point is the freezing point of sodium chloride, 801° C.

To Women War Workers. By Lilian A. Evans, R.S.I. Price 6d. —This is a booklet issued by the St. Helens Cable and Rubber Co., Ltd., Warrington (from whom copies may be obtained), and consists of homely advice in regard to the maintenance of the health and comfort of the women to whom it is addressed by the welfare superintendent to the above-named company. It deals with questions of suitable clothing for war workers, proper food, care of the teeth, rest and recreation, and minor ailments, in simple, concise, and lucid terms, and is packed full of common-sense and sound knowledge of the subjects to which it relates. We must congratulate all concerned the author on the ability with which she has produced this admirable guide; the women workers who, we hope, will profit by its teachings; and the firm who are so fortunate as to include Miss Evans on their staff—and we trust that the booklet will be given the widest possible circulation amongst working women no matter what their occupations.

The Practical Electrician's Pocket-Book and Diary, 1918.—Edited by H. T. Crewe, M.I.Mech.E. London: S. Rentell & Co., Ltd. Price 1s. 6d. net. This is the twentieth issue of the well-known pocket-book whose appearance has been delayed by difficulties in production. However, the work has undergone the usual revision: the chapters on illumination and telephones have been re-written, new chapters on shot-firing, mine exploders, &c., and the control, management, and range of search-lights have been inserted, and various other improvements have been made. So useful and familiar an annual needs no recommendation.

"The Central." Vol. XIV, No. 42. December, 1917.—This issue contains articles on "The Amritsar Hydro-electric Pumping Scheme," by L. King, A.C.G.I.; "The Heat Treatment and Testing of Alloy Steels for Aero-Engines," by R. A. S. Thwaites, A.C.G.I.; "Recent Crystallographic Work at the Central Technical College," by E. H. Rodd, A.C.G.I.; and the usual "Old Student Notes," Reviews, &c.

"Interior Wiring." By A. L. Cook. London: Chapman & Hall. Price 9s. 6d. net.

"Theory and Operation of D.C. Machinery." By C. M. Jansky. London: Hill Publishing Co. Price 10s. 6d. net.

"Dictionary of Aircraft." By W. E. Dommett. London: Electrical Press, Ltd. Price 2s. net.

The Faraday House Journal for the Lent Term contains obituary notices of Lieut.-Col. R. W. Hammond, Second Lieut. E. B. Ritson, and Private W. C. Radford, as well as the usual personal items and list of students serving with the Colours.

For Sale.—Hampstead B.C. electricity department is inviting tenders for 637 old type electricity meters and about 600 Wright's maximum demand indicators. See our advertising pages to-day.

Trade Announcements.—Mr. James Espie, of 36 to 38, Smith Street, Kinning Park, Glasgow, will in future act for Messrs. T. W. Broadbent, Ltd., of Huddersfield, as their agent in Scotland for the sale of their generators, motors, switchboards, &c. Mr. Espie has installed many of the company's machines for shipping and other work during the past few years.

The Metallic Seamless Tube Co.'s electrical engineering department has made such headway that it has been found advisable to form a separate company under the title: The Metallic Electrical Engineering Co., Ltd., for all electrical engineering supplies, the address being 153, Corporation Street, Birmingham. The arrangement will enable deliveries to be expedited, and will not affect prices or terms now in operation.

Calendars.—Messrs. Atkinson, Lloyd & Co., Ltd., of 15, Blackfriars Street, Salford, Manchester, have issued a calendar with two-monthly sheets for 1918. The pictorial feature on each sheet aims at exploding some of our popular superstitions.

Messrs. C. A. Vandervell & Co., Ltd., of Acton, have sent us some copies of their useful "moon chart" for February.

"Sterling" Concert.—To-morrow, Saturday evening, at 6.30 o'clock, there will be a concert arranged by the Sterling Athletic and Social Club, in the New Recreation Hall, which the directors of the Sterling Telephone and Electric Co., Ltd., have built at Dagenham. Well-known London performers have been engaged.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Publication containing price lists of "All-British" arc lamp carbons—"Apostle," "Witton," flame, and "Kinarko" (kinematograph).

Mr. George Ellison, Birmingham.—Twenty-four-page catalogue containing very full and illustrated description of their totally enclosed oil-break circuit breakers for industrial purposes (A.C. and C.C., 750 volts). The different methods of connecting cables have received careful consideration, and the breaking capacities of the switches are stated definitely. The figures of the latter are based on actual tests. These circuit-breakers are supplied in large quantities for controlling independent circuits and motors, and are also mounted in groups together with bus-bars and the necessary accessories to form main switchboards. Prices are tabulated and dimensions are set out in detail.

Messrs. Vickers, Ltd., of 57, Victoria Street, S.W. 1, have issued through their Electrical Sales Department another excellent publication forming part of their foreign trade propaganda efforts. The letterpress is in Russian, and the booklet contains some 60 or more art pages of choicely executed photographic views of their works, turbo-generators and other plant, motors, motor-driven machinery, switchgear and controlling apparatus, &c.

Liquidations.—Rural Districts Electrical Undertakings, Ltd.—Meeting, March 11th, at 24, Martin's Lane, London, to hear an account of the winding up from the liquidator.

Balcke & Co., Ltd.—A petition presented by the B. of T. under the Trading with the Enemy Amendment Act for the winding-up of this company is to be heard on February 19th.

National Union of Manufacturers (Inc.).—The first annual general meeting of this Association was held, last week, at 6, Holborn Viaduct, E.C. Mr. Geo. Terrell, M.P., the president, was in the chair.

The president (Mr. Geo. Terrell, M.P.) was unanimously re-elected. Reference was made to the excellent work of Mr. Cheeseman as secretary, and he was re-elected.

The chairman said in regard to the activities of the Association during the year, they had attempted, and with a considerable measure of success, to impress upon the Government that manufacturers as a body should be consulted upon all matters which affected labour or their businesses. In the past the Government had consulted the Trade Unions, their own officials, politicians, and amateurs, and also what they (the Government) called business men. He did not think that was fair, and their Association had used every opportunity of impressing upon the Government that they should take organisations like theirs into their confidence and consult them as to what they wished done. A monster deputation had been presented to Dr. Addison when he was Minister of Munitions, and in this they had been supported by the Federation of British Industries and by the controlled firms, and as a result of the representations then made, Dr. Addison had agreed that an Advisory Committee should be set up by which they were to advise in labour and manufacturing matters. Then a deputation was sent to Mr. Churchill, who succeeded Dr. Addison, but they did not get much encouragement from Mr. Churchill, and as they knew, that gentleman's reign up to the present, from a financial point of view, had been a disaster. Dealing with the question of the extra 12½ per cent. which had been granted to workers, the chairman said that the Engineers Employers' Federation had been consulted and had given sound advice to the Ministry, but they had been turned down. It was a pity the Federation had not consulted their Association; for, after all, what were all these organisations for if they were not to support each other? The manufacturers wanted to be on the best of terms with their men, and were always willing to give the men more money for more output; but the workers must realise that as the cost of labour was increased so the cost of the article which labour produced was increased. He had consulted the Prime Minister on these points, and had found him most sympathetic. He proceeded to give an instance of an important Committee which had been set up to consider and report upon arrangements which should be made for the demobilisation of workers engaged during the war in certain factories, controlled establishments, and other firms engaged on munitions. The Committee in question consisted of 18 members, of which seven were Government officials, seven were representatives of Trade Unions, and only two were employers; thus the whole of the British manufacturing trade was represented by those two men. Dr. Addison had since written to him agreeing to three additional representative manufacturers being nominated by the Association to serve on that Committee. Their Association had also intimated that they ought to be consulted in regard to the New Man Power Bill, and the result was that a meeting of employers was convened by Sir Auckland Geddes, and they were told what the Government intentions were, and invited to question and criticise the proposals.

The following resolution was moved by Mr. Arthur Berkeley (Berkeley & Young, Ltd.):—

> That this Union endorses the action of the United States Chamber of Commerce in notifying German business men that future trade relations will not be established with Germans unless and until a responsible Democratic Government is established in Germany, and this Union urges all business men in Great Britain to adhere to this policy as the best means of destroying militarism.

Patents in Morocco.—It is announced in the *London Gazette* that the provisions of Section 91 of the Patents and Designs Act, 1907, are to apply to that part of the Empire of Morocco which is under French Protection, as from August 1st, 1917.

LIGHTING AND POWER NOTES.

Bacup.—The Electricity Committee is asking for another conference with Rawtenstall on the question of special supplies of electricity. Difficulties have arisen out of the recent agreement between the two authorities.

Bedford.—New Plant.—The T.C. has instructed the consulting engineer to prepare plans and specifications for the installation of a 1,500-KW. plant at the generating station.

Belfast.—At the last meeting of the Tramways and Electrical Committee, the consideration of the extensions at the Queen's Island was deferred till a special meeting could be held. The ground originally intended for the site of the new generating station is now needed as part of a great extension of the Queen's Island shipbuilding works. Lord Pirrie (Messrs. Harland & Wolff, Ltd.) has suggested an alternative site, and, as the shipbuilding industry is one of the two chief industries of the commercial capital of Ireland, every consideration must be given to it. The Electrical Committee is to meet his Lordship at the works. The extension of Messrs. Harland & Wolff's will mean a great extension of electrical plant and power at that place.

Blackburn.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £115,000 for a proposed new electrical generating station at Whitebirk. The Electricity Committee had previously considered, and adopted, a report by Mr. Wheelwright, the electrical engineer, on the urgent necessity of providing for a proper supply of electricity for the town, and to economise in coal consumption, and had recommended that steps be taken at once to erect on the site at Whitebirk the first instalment of the proposed new works, to consist of a generating unit complete with an output of 5,000 kw., and that arrangements be made, if possible, with the Gas Committee for the boilers to be gas-fired.

Bootle.—Linking-up.—The T.C. has discussed a new scheme for linking-up with the Liverpool electricity undertaking: the scheme was proposed by the Ministry of Munitions as an alternative to the provision of additional plant at the Bootle generating station. The main points of the agreement are as follows:—The supply to be for a period of three years, instead of seven, terminable then, or thereafter, by one year's previous notice, in the event of Bootle being able to obtain more favourable terms for a bulk supply from other parties.

The demand which must be met by the Liverpool Corporation must be 3,000 kw. for the commencement of the supply, instead of 1,500 kw. The tramway supply of electricity to continue to be given by Bootle.

The supply to be measured at Bootle and Liverpool boundaries: Bootle to run its plant in commission at the peak load, and no additional plant to be installed by Bootle during the three years of the agreement.

On the various points of the agreement several amendments were put forward, one, which was carried, was to render it possible to terminate the agreement, not only should Bootle be able to obtain more favourable terms from other parties, but also in the event of its being able to generate electricity at a cheaper rate.

After discussion, the Council decided to agree with the principle of the proposals, but to consider the agreement at a special meeting before finally settling the matter.—*Liverpool Post.*

Bradford.—The War Wages Committee has empowered the Electricity Committee to make payments in strict accord with the recent award of the Chief Industrial Commissioner, and the Electricity Committee is requested to make recommendations to the War Wages Committee as to the extent (if any) to which the award should be applied to the technical staff of the department.

The Electricity Committee has decided to extend the mains and build several transformer chambers for local industries, at an estimated cost of £5,900.

Bury.—Coal Conservation.—Mr. S. J. Watson, the electrical engineer, dealt with the coal conservation proposals in an address to the Bury and District Chamber of Commerce last week. He stated that he did not believe the best results would be obtained from a Government Department having complete control of the suggested scheme. If the Government assisted in the establishment of the scheme and then entered into agreements with groups of individuals to operate the stations it would be better.

Continental.—Italy.—The Societa Anonima per l'Elettrificazione dei Valichi dell' Appennino has been formed at Leghorn with a capital of 250,000 lire, and power to increase it to 1,000,000 lire, with the following scope:—Assumption of concessions and contracts for the electrification of railway and tramway lines, supply of electricity for the working of the same, construction of installations for the utilisation of water powers, &c.

Sweden.—Among the new companies recently formed in Sweden are the Gnesta Elektriskabolag, organised at Gnesta, with a minimum and maximum capital of respectively 80,000 and 240,000 kronors, to establish a central electricity supply station, and the Jokkmokkskraftbolag, formed at Jokkmokk, with a capital of 25,000—45,000 kronors, to put down a plant to utilise certain available water power in the district in the generation of electrical energy.

Doncaster.—In view of the absence, through illness, of Mr. G. A. Roberts, acting electrical engineer to the Corporation, and the importance of the local power plant being at once inspected and reported upon, the Electricity Committee has recommended that Mr. E. S. Rayner, the town's electrical engineer, be asked to obtain leave from his work for the Admiralty in order to visit the local plant, and, if possible, arrange to come to the town at intervals, or, in case of breakdown, to advise and assist the Committee.

Dublin.—With regard to the recent discussion in the City Council as to the supply by the Dublin United Tramway Co. of power for certain purposes, and to which objection has been taken by the city authorities, it was disclosed at the recent meeting of the company that the supply was given under a Defence of the Realm Act notice, after the company had advised the authorities that the Corporation had ample spare power to give the supply.

Dudley.—At the meeting of the T.C., last week, it was decided to present a petition against the Bill promoted by the Shropshire, Staffordshire, and Worcestershire Electric Power Co. Alderman Cook stated he understood the company were seeking powers to erect one of the new super-stations at the junction of the Stour and the Severn, and that the district would receive its supply from there. He had made inquiries as to the reason why Dudley could not be the centre of one of these stations, seeing that there was ample coal supply, but a director of the company informed him that water was more important than coal. He considered that if an industrial district like theirs could get cheap power from anywhere they ought to welcome it. Alderman Hughes said negotiations were going on in the district with the end in view which Alderman Cook had mentioned, and they all hoped these negotiations would be successful. Alderman Hughes added that there was plenty of coal and water below if they could only get at it.

Eastbourne.—Public Lighting.—The T.C. has decided to have 43 street gas lamps converted to electricity.

Elland.—Proposed Loan.—The U.D.C. has decided to make application to the L.G.B. for sanction to borrow £2,000 for the proposed extension of the electricity works.

Erith.—Price Increase.—The U.D.C. has decided to increase the price of current for power forthwith, owing to the higher cost of production.

Farnworth.—Electrical plant has been installed in Messrs. Harwood's Cobden Mill, under the supervision of Mr. Hutchinson, engineer to the Council. The Suez Mill Co. has also obtained his services as adviser on the installation of electrical plant.

Garforth (Yorks.).—At Garforth Collieries, recently, a new electric plant was started at the Sisters' Pit. Coal has been drawn from this estate, it was mentioned, since the thirteenth century, a reference in a Charter dated October 18th, 1262, being the earliest recorded date of coal getting in Yorkshire. The new electric plant was started by Mrs. Gascoigne, and consists of a 500-kw. mixed-pressure turbine and generator, supplying power for hauling and pumping. Electricity is also conducted to the Isabella Pit, where a turbine pump has been installed capable of pumping 800 gallons of water per minute. The current is transformed to 110 volts for lighting, and dispenses with the existing plants.

Hull.—The Electricity Committee, granting an additional war bonus of 5s. a week and also the 12½ per cent. bonus on earnings, decided that this should also apply to the technical staff, but not to the clerical staff.

Irlam.—The Partington Steel and Iron Co., Ltd., are to build a "Garden City" of 1,000 houses here, a start being made with 150 houses, the necessary Government permission having been obtained, and it is suggested that an electric lighting scheme should be adopted.

Liverpool.—At the City Council, last week, Councillor Max Muspratt referred to the interim report of the Coal Conservation Sub-Committee, and stated that the tables with regard to the average prices charged to consumers were entirely fallacious. It was important that the Corporation should decide what lines ought to be taken. It was stated that the electrical engineer would be asked to report on the question.

London.—Stepney.—The Electricity Supply Committee has received a report from the borough electrical engineer and manager recommending the provision of a sub-station in the north-eastern portion of the borough. Mr. Tapper points out that for more than a year past that part of the borough has been receiving supplies of electricity at very low pressure; the demand on the Limehouse sub-station has increased during the past four years by nearly 1,000 kw., and the low-tension feeders are now carrying about 50 per cent. more than their rated capacity, resulting in the consumers receiving current at about 16 per cent. below the standard voltage of supply. He suggests the provision of a building similar to the Wapping sub-station, with one 1,000-kw. and one 500-kw. converter, with the necessary overhead crane, switchgear, cables, &c., at a cost, based on present prices, of approximately £52,000, made up as follows:—Land, buildings, &c., £12,650; plant, £12,030; feeder cables, £22,660; contingencies, £4,660. Reference is also made to the engineer's report on after-the-war developments, in which a further extension of the Limehouse generating station was anticipated, which the engineer considers may become urgent before the termination of the war. The Committee recommends that application be made to the L.C.C. for its sanction to the borrowing of £52,000 for the new sub-station.

Hackney.—The Electricity Committee recommends that, as from the quarter ending March, 1918, the charges to all ordinary consumers for both lighting and power be subject to a percentage increase of 50 per cent.; that slot-meter consumers be charged the same minimum as flat-rate consumers, and that the price of 8d. per unit be charged.

Hammersmith.—The Electricity Committee has had under consideration extensions to the mains in the Hythe Road district. The demand is for 200-kw., and the engineer has reported upon three alternative methods of dealing with this, namely:—(1) By fixing static condensers as required; (2) by laying a new main, estimated to cost £8,100; and (3) by making use of the existing White City mains, which would have to be replaced at an estimated cost of between £8,000 and £9,000. The British Insulated and Helsby Cables, Ltd., are willing to supply suitable static condensers, at £520 each, estimated to increase the supply by 66 kw., one of which will be sufficient for immediate purposes. In the event of this condenser proving satisfactory, further condensers could be purchased and fixed as the demand increases. The Committee recommends the purchase of a static condenser.

Woolwich.—The Electricity Committee reported that the demand on the stations had overtaken the safe working capacity of the plant, and that the Council should immediately sanction the putting in hand of further extensions. The proposals include an additional boiler at Globe Lane works, extensions to coal conveyor, provision of additional elevator, extension of buildings, &c., at a cost of £25,160: the Council will receive a contribution towards the cost, and will be relieved of responsibility for outstanding liabilities on the plant should its use no longer be required to meet the Council's demand when normal conditions of working are again in operation. The Committee's recommendations were adopted.—*Kentish Independent.*

Londonderry.—An agreement has been arrived at between the Corporation and the parties who had threatened opposition to the Improvement Bill which it is promoting, one of the objects of which is the provision of a supply for the North of Ireland Shipbuilding Co.'s yard and workmen's dwellings. The minority in the Corporation, representing the Nationalist Party obstructed progress on the ground that they had no adequate representation, and formulated a demand for an extension of the city boundaries.

Morecambe.—Price Increase.—The T.C. has advanced the price of energy for lighting for any quantity up to 20 units per quarter to 10s. 10d., and 6½d. per unit beyond; and power to 6s. 10d. up to 20 units per quarter, and to 3½d. for each unit beyond, as from March 31st next.

Newcastle-under-Lyme.—Linking-up.—At the last meeting of the T.C., a recommendation of the Electricity Committee was approved making application to the L.G.B. for sanction to borrow £3,000 for the purpose of linking-up the electrical undertakings of Stoke and Newcastle.

Nottingham.—At the Council meeting, last week, Alderman A. Ball, referring to the Committee formed to develop the Colwick Estate, drew attention to the Colwick weir as a site for a power plant.

It was suggested that if the water of the Trent were used for condensing purposes in a modern steam turbine-driven power station, 150,000 kw. could be obtained there; the Electricity Committee agreed that this was possible, and hoped after the war to be able to erect such a station.—*Nottingham Evening Post.*

Portstewart.—Street Lighting.—The Council has received a reply from Mr. F. McLenahan in answer to the Council's offer of 30s. per lamp for the lighting of the town with electricity, stating that he is prepared to accept 35s. per lamp. It was decided to accept the proposal, and 49 lamps are to be installed.

Salford.—At the last meeting of the T.C. it was reported that by a decision of Sir George Askwith as to the increase in the rates of pay to workpeople engaged in the generation and distribution of electrical energy, the cost of the increases (as the result of his last award) meant an additional expenditure to the department of £3,000 per annum.

Sheffield.—A 10-in. rod rolling mill at the works of the Hallamshire Steel and File Co., Ltd., Neepsend, has recently been converted to electric driving. The mill is driven by a 200-h.p. G.E.C. motor through a flexible coupling and a laminated reduction gear having a ratio of approximately 4 to 1.

Shropshire Power Co.'s Bill.—A resolution was passed at the last meeting of the Worcester City Council, authorising the Committee concerned to instruct counsel to oppose the Bill promoted by the Shropshire, Worcestershire and Staffordshire Electric Power Co. (now before the House of Lords), or compromise on such terms as thought fit.

At a meeting of the Board of Conservators for the Severn Fishery District, the chairman stated that it was proposed by the Shropshire Electric Power Co. to take lands at Stourport with a frontage to the Severn and Stour, and to erect works for generating electricity and the manufacture of gas; and there was another Bill proposing to give powers to the Gloucestershire Electric Power Co. for erecting similar works at Bullo, below Newnham. It was proposed that the work at Stourport should be proceeded with at once, but it would be some little time before work was begun at Bullo.

Skelton and Brotton.—A special meeting of the Council considered the question of revising the system under which electricity is supplied by the Council to certain consumers for lighting purposes. The electrical engineer reported that a majority of the consumers paid for the current on a flat rate basis of so much per week, which he found operated to the disadvantage of both the consumer and the Council. If consumers paid by meter they and the Council would benefit. He also suggested that the present quarterly minimum fee charged to meter consumers be abolished, and a minimum half-yearly change substituted to cover the heavy and light periods alike. It was decided that steps be taken to revert from the flat rate to the meter system of payment for the whole of the consumers, and the suggestion with regard to the minimum was also adopted.

South Shields.—At a meeting of the T.C., on the 6th inst., Ald. Henderson, in moving the adoption of the annual report of the Electricity Committee, said it was working under abnormal conditions, and if it had not been for the lighting restrictions, the income would have been something like £40,000, instead of £32,000. It was not fair to say that the undertaking was losing money; there was a gross profit of 6 per cent. on the capital of the undertaking. The amount by which they had fallen short of paying interest and sinking fund charges was £3,028, and they proposed to make up that shortage from the reserve fund, leaving a balance of £12,189. It was decided to make a charge for meter rent for consumers of electric power.

Watford.—Plant Extension.—The L.G.B. has authorised the U.D.C. to proceed with extensions to the electricity plant, for which sanction to a loan of £17,800 was applied for, pending the receipt of certain particulars before the loan is formally sanctioned.

Whittlesea.—The Council has agreed to pay an increase of 15 per cent. for electrical energy purchased from the Peterborough Electric Traction Co. for the 12 months dating from October 27th, 1917.

Wigan.—At the T.C., last week, Alderman Grimshaw, in moving the minutes of the Electricity Committee, said there had been a considerable increase in the output of the works, the total output for December being 859,011 units, as against 619,639 in December, 1916, an increase of 239,372 units. Referring to the recent wages award, Alderman Grimshaw said that, compared with pre-war times, there was an increase of £42 per week in wages.

Wolverhampton.—Proposed Loans.—Application is to be made to the L.G.B. for sanction to the borrowing of £4,500 for the purpose of carrying out alterations to the switchboard at the Corporation electricity works; also of £326 for the purchase of a 300-k.v.a. transformer. The switchboard is to be divided into sections with reactance coils between. Tenders are to be obtained for the reactances.

Wormit.—Price Increase.—The Tayside Electric and Gas Light Co. has notified its consumers of electricity that after April next lighting charges will be increased to 7d. per unit and contracts by 17 per cent.

Worthing.—Tar Oil.—The T.C. has decided to comply with the request of the Ministry of Munitions to use where possible tar oil, instead of American and other oils, for the electricity plant, and one of the engines is to be fitted with tar-oil apparatus, at an approximate cost of £160.

Yorkshire Electric Power Co.'s Bill.—At a conference of the West Riding local authorities at Wakefield, the proposals of the Yorkshire Electric Power Co. with a view to the extension of its powers of supply of electrical energy were considered, and the following resolution was carried:—"That this conference is of opinion that the Bill now being promoted by the Y.E.P. Co. seriously prejudices the rights of local authorities within the area of supply, and recommends that the Bill be opposed." It was further recommended that local authorities concerned should combine for the purpose of opposing the Bill, and that the costs incurred in such opposition following the lodging of the petitions should be shared on the assessable valuation basis.

The Ardsley, Dewsbury, Kikheaton, Marsden, Monk Bretton, Royston, and Wharfedale Councils have decided to petition against the Yorkshire Electric Power Co.'s Bill. The Soyland, Farnley Tyas, and Queensbury Councils will support the measure.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—Regarding the local tramway dispute, a joint conference of representatives of the Corporation and the men was held on February 7th. The proceedings were of an amicable character, and, as a result of the deliberations, it is anticipated that there will be no further trouble, though some details remain to be finally settled.

Bradford.—The Tramways Committee has recommended to the City Council that, in its opinion, the time has now arrived for the manager (Mr. C. J. Spencer), who has been engaged for more than a year on work for the Admiralty, to return to Bradford, in order to resume active control of the tramway undertaking, which is at present more than ever in need of the manager's personal and continuous supervision, and that the town clerk be instructed to communicate with the Admiralty with a view to releasing him at an early date.

The annual concert promoted by the tramway employés, at St. George's Hall, was a great success. The municipal authorities were officially represented, and most of the departmental heads of the tramway undertaking, as well as the chairman and many members of the Tramways Committee, were present.

Up to date, it is recorded that 54 employés of the Bradford tramways have given their lives in the war.

Croydon.—The T.C. is considering the question of opposing the Bill of the London United Tramways, Ltd.

Edinburgh.—The general manager of the tramway company has issued a warning as to possible interruption of service due to the wearing out of the cables, which it is impossible to renew as under normal conditions. The system, it may be recalled, is operated by cable traction.

Halifax.—Wages and Fares.—The T.C., last week, adopted an amended resolution by the War Wages Committee, urging the Government to put a check on the constant advance of the wages bill by fixing a time limit within which no further applications shall be made after advances have been granted.

The Council, by a large majority, rejected an amendment that Tramways Committee minutes recommending increases of fares be referred back.

The same meeting adopted a resolution instructing the Tramways Committee to reopen the West End circular route, recently closed. The Tramways Committee held that this route, which has only existed two years, has never paid, and that the district is well served by other routes.

Leeds.—Parcel Delivery.—The Chamber of Trades has decided to recommend all traders to give hearty support to the new scheme of the Tramways Committee for parcel delivery by the tramways, in order to relieve other transport.

Liverpool.—At the City Council, last week, Councillor H. Rathbone criticised the propriety of accepting such large contributions towards the relief of the rates as £125,000 from the tramways and £65,000 from the electricity undertaking. The state of the tramway, permanent way, rolling stock, &c., he said, could not possibly be as efficient as it ought to be, and when the time came for development an enormous expenditure would be necessary. Alderman Russell-Taylor, chairman of the Tramways Committee, said the position of the Committee fully justified such grants being made. The equipment of the system was as good to-day as before the war. They were short of labour, however, and wanted 140 more drivers; if these were obtainable they could put 100 additional cars on the track.

London.—Post Office Railway.—The accounts for the period ended March 31st, 1917, of the Post Office (London) Railway show a total expenditure of £600,128, which comprises the following items:—Preliminary expenses, professional fees, &c., £27,172; experimental plant, £5,467; tunnelling, £495,717; stations, £21,948; earthworks, &c., £10,050; land, buildings, and easements, £37,752; electrical equipment, £2,016. The balance of authorised issue unexpended for the period under review was:—In hands of the Post Office, £12,871; unissued, £499,871, making a gross amount of £1,100,000.—*Morning Post.*

Manchester.—Tramway Fares.—At the last meeting of the T.C. an effort was made to induce the Tramways Committee to consider the desirability of extending the workmen's cheap fares up to 8 a.m., instead of 7 o'clock as at present. In reply, Alderman Bowes, the chairman, contended that practically all their fares were workmen's. There was a possibility that before many weeks were over, the Committee would ask the T.C. for sanction to again increase the fares. The proposal was defeated by a large majority.

Oldham.—Mr. P. Priestley, manager of the Corporation Tramways, reports that at present he cannot carry out the necessary repairs to the permanent way, on account of having no tar or oil.

Rochdale.—Electric Vehicles.—After a long consideration of the question of municipal haulage, the T.C. has decided to purchase three electrically-driven motor wagons, chiefly for use in the gas and electricity departments.

South Shields.—Year's Working.—At a meeting of the T.C. on the 6th inst., Alderman Wylie, moving the adoption of the annual report of the Tramways Committee, said the receipts amounted to about £44,000, and the year ended with a substantial balance. The reserve fund had reached the maximum of 25 per cent. of their capital expenditure, which was £181,000, they had also put aside £3,040 for maintenance work which could not be done on account of the war. The balance (£4,100) to go to the relief of the rates, represented about 2½d. in the £.

York.—Fares.—In presenting the minutes of the Tramways and Electricity Committee, Alderman Meyer said they proposed on March 1st to increase the fares to the maximum of a 1d. per mile, and ultimately they proposed to ask for power to increase the maximum. As regarded the electricity undertaking, owing to the award of £1 per week above pre-war wages plus 12½ per cent., the charges would have to be increased.

The Council decided to increase the price of dinner hour and War Office tickets one halfpenny on the return journey, War Office quarterly contract tickets are to be discontinued, and preliminary steps are to be taken to obtain authority to charge increased fares.

TELEGRAPH AND TELEPHONE NOTES

Dutch Cables.—The embargo on Dutch cables has been provisionally raised, allowing of the restoration of commercial telegraphic communication between Great Britain and Holland.

Leeds.—The arrangements for the change-over of the Leeds telephones to the automatic service are now almost complete. It is stated that of the 8,000 instruments that will come under the scheme, about 2,000 had been fixed by the end of 1915. The call to the Colours of all fit men and the consequent depletion of the telephone staff then considerably delayed the alteration.

Motor-Cycles in Telephone Service.—The New York Telephone Co. has recently placed an order for 100 motor bicycles for the use of its staff engaged in its repair and maintenance department in the Greater New York district. The tests that have been carried out show that, owing to the quicker transportation that is possible by the motor-cycles, the work of the department can be carried on at a less cost than hitherto.

Uruguay.—The Department of Posts and Telegraphs is studying a proposal for the installation of an automatic telephone service in Monte Video.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

Adelaide.—February 27th. P.M.G.'s Department. Telephone material. Schedules 179 and 183. See "Official Notices" January 18th.

Belfast.—March 9th. Tramways and Electricity Committee. Tramway Stores, including cable, lamps, carbon brushes, &c. See "Official Notices" to-day.

Cavan.—March 4th. B. of G. Storage battery, wiring, electrical-driven pumps, pipes, &c. See "Official Notices" to-day.

Croydon.—February 18th. Tramways Department. 3, 6, or 12 months' supply of general stores: Tramways Manager, Thornton Heath Depôt.

Dublin.—February 19th. Electricity Supply Committee. Repairs to boilers. See "Official Notices" to-day.

London.—L.C.C. February 18th. Tramways Department. 4,500 forged steel driving wheel tires, and 3,000 forged steel trailing wheel tires. Manager, L.C.C. Tramways, Belvedere Road, S.E. 1.

H.M. Office of Works. February 20th. Copper conductors, &c. See "Official Notices" to-day.

Newport (Mon.).—February 18th. Electricity Department. One 3,000-kw. turbo-alternator and surface condensing plant. See "Official Notices" February 1st.

Warrington.—February 26th. Electricity Department. Steam pipework. See "Official Notices" February 8th.

March 5th. Electricity Department. E.H.T. switchgear. See "Official Notices" to-day.

CLOSED.

Bolton.—Electricity Committee. Accepted tenders for plant at Back-o'-th'-Bank electricity works.

British Thomson-Houston Co., Ltd.—Turbo-alternator.

Hick, Hargreaves & Co., Ltd.—Condensing plant.

British Westinghouse Co., Ltd.—Switchgear.

Babcock & Wilcox, Ltd.—Boilers, stokers, &c.

E. Green & Sons, Ltd.—Economisers.

Ledward & Becket.—Water screening plant.

The Committee has also accepted the tender of Messrs. Drake and Gorham for a one-ton electrical vehicle.

Bradford.—Electricity Committee:—

Brush Electrical Engineering Co., Ltd.—Two K.V.A. transformers, and one 600-K.V.A. transformer.

British Electrical Transformer Co., Ltd.—Two 1,000 K.V.A. transformers.

Goodall, Clayton & Co., Ltd.—Coal handling plant.

British Westinghouse Co., Ltd.—Three oil switches.

John Wolstenholme & Son., Ltd—Circulating water pipes.

Mather & Platt, Ltd.—Two 625-B.H.P. motors (inclusive of starters and switches) for driving circulating water pumps, also three centrifugal boiler feed pumps.

Tramways Committee:

National Rail & Tramway Appliances Co., Ltd., and Cole, Marchent and Morley, Ltd.—Supply of brake shoes.

John Brown & Co., Ltd.—400 steel tires, approximately £2,000.

Wolverhampton.—Corporation. Accepted tenders:—

T. & S. Ham.—Laying foundations for the cooling towers at electricity works, £601.

Willans & Robinson, Ltd.—Spare parts for the 5,000 kw. turbine sets, £158.

Gibbons Bros.—Steel chequer flat flooring, £78.

Reyrolle & Co.—Switch panel to central or rotary converter, £434.

Lea Recorder Co.—Water measuring recorder for use in connection with a 5,000-kw. turbo-alternator, at £98.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, February 15th. At 6.15 p.m. At the Holborn Restaurant (Venetian Chamber). Concert (Ladies' Night).

Institution of Mechanical Engineers.—Friday, February 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting.

Royal Institution of Great Britain.—Saturday, February 16th. At 3 p.m. At Albemarle Street, W. Lecture on "Problems in Atomic Structure" (Lecture I), by Prof. Sir J. J. Thomson.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, February 16th. At 4.30 p.m. At the Royal Technical College, Glasgow. Paper on "Steam Turbines as Applied to Colliery Work," by Mr. P. J. Pliven.

Royal Society of Arts.—Monday, February 18th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "The Economic Condition of the United Kingdom Before the War; the Real Cost of the War; and Economic Reconstruction" (Lecture I), by Mr. E. Crammond.

Institution of Civil Engineers.—Tuesday, February 19th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "Modern Developments in Gasworks Construction and Practice," by Mr. A. Meade.

Greenock Electrical Society.—Thursday, February 21st. At 7.45 p.m. At 22, West Stewart Street. Paper on "Notes on Electric Furnaces," by Mr. F. H. Whysall.

Belfast Association of Engineers.—Thursday, February 21st. At 7.45 p.m. At the Municipal Technical Institute. Paper on the "Decimal System," by Dr. W. J. Crawford.

Institution of Electrical Engineers.—Thursday, February 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Switchgear Standardisation," by Dr. C. C. Garrard.

(Birmingham Local Section).—Wednesday, February 20th. At 7 p.m. At the University, Edmund Street. Paper on "Switchgear Standardisation," by Dr. C. C. Garrard.

NOTES.

After-War Trade and Standardisation.—In the "Board of Trade Journal" for February 7th, extracts are given from reports of the Departmental Committees bearing upon the subject of standardisation. It is pointed out that our foreign competitors in the majority of industries carrying on an active export trade have organised production, so that individual manufacturers can concentrate their efforts on a limited range of standardised products. The principle of standardisation is approved by the Committees, and their reports show that effective standardisation cannot be achieved without the closest co-operation between manufacturers.

Standard ships and engines are already being built, but in these cases the object is the rapid completion of the largest possible amount of tonnage rather than the construction of the most efficient types of ship; the process of standardisation is being carried further, and the Shipping and Shipbuilding Industries Committee recommends that a joint committee should be formed under the Engineering Standards Committee to promote the movement.

The Committee which inquired into the engineering trades also considers that the variety of patterns manufactured could be reduced with advantage, and contrasts the excellent results accruing from the standardisation of locomotives for India with the diversity of designs in use in England, where each great railway builds its own engines, and British consulting engineers for foreign railways all have ideas of their own which necessitate separate drawings and patterns for almost every locomotive produced, causing considerable waste. In the case of machine tools, American manufacturers have captured a large proportion of the trade by turning out standard types of machines, and similar advantages have been gained by standardisation in the Swiss watch trade, and American agricultural implements, motor-cars, typewriters, and telephone appliances.

The admirable work accomplished by the Engineering Standards Committee is adequately recognised, and the Engineering Trades Committee recommends that the Government should increase its financial support to the work of the E.S.C.

In the report on the Electrical Trades, the combination of manufacturers is advocated in order to secure the extension of standardisation "which the Committee considers is of the highest importance from a national as well as from an international point of view. It is to be hoped that the Government will do its utmost in the future to accept recognised standard plant, as its example in the past, in calling for modifications, has had a pernicious influence on other buyers. During the war makers' standards have perforce been accepted, and have been found to satisfy all practical requirements."

With regard to foreign trade, "makers must be prepared to adjust themselves to the need of the country concerned, where accessories of a different type have become universal."

In the report on the Iron and Steel Trades, the Committee refers to the excessive variety of sizes and weights of sections, due largely to the divergent requirements of British consulting engineers, and the tests with which manufacturers have to comply are often too severe, and of "immense and almost capricious variety"; the Committee holds that the tests laid down by the Engineering Standards Committee should be adopted in all cases.

The Committee on the Textile Industries also recommends standardisation so far as is practicable.

"The St. Helen's Co."—In our issue of January 4th, Mr. J. H. C. Brooking, manager of the St. Helen's Cable and Rubber Co., Ltd., commenting on a reference to Mr. F. L. Rawson as "consulting engineer to the St. Helen's Co.," wrote pointing out that the latter was not the company with which he (Mr. Brooking) was connected. We have now received a letter from Mr. Henry James Snell, in which he explains that "The St. Helen's Co., Ltd.," is the company that was formed to carry out the process, which he invented, for the extraction of gold from sea-water, and that Mr. Rawson has acted as consulting engineer to this company from its inception. Mr. Snell also details the history of the concern, the largest holders in which are himself and Mr. Rawson. During the last 12 years the company has "made over 80 most careful official trials of the process with 26 different plants." The exploitation of the process has been held up by the war.

We regret that we cannot spare space to publish the letter, which would occupy two columns.

Association of Electrical Station Engineers, London.—The annual meeting was held on February 5th, at St. Bride's Institute. Over 200 members were present, representing 43 company and municipal electricity supply undertakings.

The President, Mr. H. W. Healy, Battersea, gave an account of the work of the Reconstruction Committee during the past few months, and the very gratifying influx of new members. The Selection Committee had insisted that only qualified engineers should be accepted, and, in consequence, many applications were refused. He hoped that in the near future the Association would provide for a Junior Section. The Committee had kept in touch with the kindred Associations in Scotland and the provinces, and at the National Conference to be held on the 11th inst. representatives from these would be present.

The Secretary, Mr. W. A. Jones, Leyton, read the annual report, in which he mentioned those cases of members' disputes with employers which the Association had been compelled to take to arbitration, and in all of which they had been successful in their claims. The membership now comprised all grades of technical staffs, from chief assistant to junior engineer, and there had recently been a marked increase in the number of senior engineers joining the Association.

The balance-sheet showed the Association to be in a healthy financial condition.

On account of his leaving Battersea to take up a new appointment, it was regretted that Mr. Healy, to whose energy the Association owed its present flourishing condition, had found it necessary to resign from office.

New officers were nominated, and the following were elected:—

President.—Mr. A. C. Bostel, Croydon.

Vice-President.—Mr. W. J. Jeffery, Charing Cross, West End and City Electric Supply Co., Ltd.

Hon. Secretary and Treasurer.—Mr. W. A. Jones, 37, Wallwood Road, Leytonstone, E. 11.

Publicity Secretary.—Mr. G. C. Law, Barnes.

Committee.—Messrs. Chapman, London and North-Western Railway Co.; Christmas, Islington; Clare, Woolwich; Giffen, West Ham; Healy, Battersea; Hewitt, Charing Cross, West End and City Electric Supply Co., Ltd.; Mann, South London Railway Co.; and Wilcocks, Hammersmith.

A presentation was made to Mr. W. A. Jones for his ungrudging efforts on behalf of the Association, and, at the close of the general meeting, a few members presented cigarette cases to Messrs. Healy and Jones in token of appreciation of their services.

Electrical Power Engineers' Association.—A National Conference of the Association of Electrical Station Engineers was held, on the 11th inst., at St. Bride's Institute, Fleet Street, London. Representatives attended from London, Manchester, Sheffield, and the Midland Electric Power Supply Engineers' Association, and a telegram was received from staff engineers in Bradford assuring the Association of their hearty support in the reconstruction. The chair was taken by Mr. W. A. Jones, the president of the National Association.

It was agreed that three centres be fixed—Manchester, Birmingham, and London—each to control the affairs of their sections in the areas as under:—

1. Manchester:—The area north of Nottingham, Chester, and Stoke, including North Wales.
2. Birmingham:—South of the above line and north of Gloucester, Northampton, and Peterborough, including South Wales.
3. London:—South of Gloucester, Northampton, and Peterborough.

It was proposed by Mr. Thomas (Manchester) and seconded by Mr. Burgess (Birmingham), "That the title of the National Association be altered to 'The Electrical Power Engineers' Association.'"

After carefully examining the question of registration or incorporation, the meeting, acting upon legal advice, resolved that the Association should operate under registration.

It was decided that the Selection Committees be instructed to maintain a high standard of qualifications, and that qualified engineers in charge of power plant in factories should be eligible for membership.

It was resolved that the National Executive Council should comprise the president, secretary, and two nominees from each of the three divisions.

The Section Committees are to submit their proposals concerning the revision of rules to the National Executive Council for final consideration.

The resignation of the National Secretary, Mr. W. J. Ebben, was received with regret, and a Sub-Committee was appointed to arrange for some recognition of the services rendered by Mr. Ebben in the pioneer work of the original Association. Meanwhile, Mr. Jones agreed to act until the appointment had been filled by the National Executive Council.

The claims of the Electrical Trades Benevolent Institution were brought before the Conference, and it was decided that it was deserving of the whole-hearted support of the members, and that particulars and forms of application for membership be supplied to each section. Cases of timely assistance rendered by the Electrical Trades Benevolent Institution were quoted, and it was felt that the good work done among staff members of the electrical industry and their dependents was such as demanded the help of the members of the Electrical Power Engineers' Association.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending February 23rd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Second Lieut. H. J. Golding.

Next for Duty.—Lieut. P. Bowden.

Monday, February 18th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 19th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, February 20th.—No. 1 Company, Entrenchments, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 21st.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, February 22nd.—Musketry, 5.30—8.

Saturday, February 23rd.—Knotting, &c., for the whole corps, 2.45—4.45. Musketry, 2.45—4.45.

Special Notices.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Inquiries.—Makers of the "Victor" insulators are asked for.

Birmingham Manufacturers and the Whitley Report.—A Conference of representatives of employers in the metal, engineering, and connected trades of the Birmingham district was held recently, with the object of considering the Whitley Report. Representatives attended from six important federations and associations of employers.

According to the *Times*, the tone of the discussion was generally in favour of the objects of the Report, while critical of some of the methods proposed. Several of the representatives were inclined to emphasise the unity of interests among all the trades of such a district as that of which Birmingham is the centre, and to urge that this fact was not sufficiently recognised in the Report.

Using the Metric System.—In the *American Machinist* of January 19th, Mr. F. Thun, Secretary of the Textile Machine Works, Reading, U.S.A., commenting on an article: "Why Force us to Speak a Foreign Language?" says: "We wish to state that we are partial to the metric system, for the reason that we have been using it in some part of our work for the last 20 years. We cannot consistently oppose the efforts to introduce the metric system into this country. Our reason for this position is due to the fact that we had to adopt the European standards in order to be able to compete in the world's markets for some of our specialities.

According to the *New York Tribune*, the U.S.A. War Department has adopted the metric system of measurement for artillery and machine guns and maps for the use of the American oversea forces; the change was agreed upon at the suggestion of the French Government, to avoid confusion in France, where the metric system is used exclusively.

In an address to the London Chamber of Commerce on February 1st, Viscount Hythe, who has recently conducted an inquiry in Italy on trade matters, stated that it was important that British manufacturers exporting to Italy should use Italian coinage and the metric system.

Dublin and District Linking-up.—The local Linking-up Committee, of which Major O. T. O'K. Webber, R.E., is chairman, and Mr. R. N. Eaton, hon. secretary, has issued an interim report dealing with certain interconnections of existing stations which can immediately be made at a small capital outlay, and will result in a saving of fuel. The total output of public and private power plants in the district at present exceeds 20,000 KW., and is expected to exceed 30,000 KW. shortly. All the stations except those of the Corporation (Pigeon House) and the Tramways Co. (Ringsend) are small, and only they and the Port and Docks Board station have adequate coal and water facilities.

At present there are seven generating stations as follows:—Dublin Corporation, max. load 7,600 KW., three-phase, 51·5 cycles; Dublin United Tramways Co., maximum load 3,600 KW., three-phase, 25 cycles, and D.C. Also the following direct-current plants:—Rathmines U.D.C., maximum load 552 KW.; Pembroke U.D.C., maximum load 562 KW.; Dublin and Lucan Railway, maximum load 200 KW.; Sutton and Howth Tramway, maximum load not given; and Dublin Port and Docks Board, maximum load 500 KW.

The proprietors of the Dublin and Lucan, and Sutton stations are desirous of obtaining an immediate bulk supply either from the Corporation or Tramway Co. Investigation shows that there would be a saving in generating costs, after allowing for transmission and conversion, of £2,511 by the Lucan Co. purchasing its energy from the Dublin United Co., and that a saving of over 1,000 tons of coal per annum would result.

In a similar way a saving of £3,573 and 1,317 tons of coal per annum would result in the case of the Sutton station. An immediate linking-up could be made between the Port and Docks Board's station and either the Corporation or Tramway Co.'s stations; the Committee suggests that a three-phase sub-station should be installed at the power station of the Board and a three-phase distribution system laid down for the supply of the shipbuilding yards, engineering works, and warehouses.

The Pembroke and Rathmines generating stations are moderately economical, and both are combined with refuse destructors, which provide part of the steam; the Pembroke station includes two Diesel engines, which are now being run on tar oil obtained from the local gasworks. Linking-up could be carried out at moderate expense, and would yield immediate economy.

The cost of linking-up is estimated at £2,100, and it is believed it would be possible to shut down the Rathmines undertaking, so far as the coal-fired boilers are concerned, for six months in the year, saving 800 tons of coal.

The Committee considers it desirable to link up either the Pigeon House or Ringsend stations with the Pembroke Council's station, and that through-running should be further developed between the Dublin and Blessington and Dublin United Tramways.

The question of providing power on a large scale at a very cheap rate for the power users at present generating their own power, and for bulk supply to the townships of Blackrock, Kingstown and Dalkey, is engaging the attention of the Committee, as also the linking-up, or amalgamation, of the Ringsend and Pigeon House plants.

A Lightning Stroke.—According to the *Times*, during a thunderstorm at Bakewell, on Saturday night, a woman was struck by lightning and was blinded in both eyes.

Appointments Vacant.—The Liverpool Tramways Committee has decided to advertise for a deputy general manager for the undertaking, at a salary of £800 per year; fitter-driver (56s.) for the Horsham U.D.C. electricity department; assistant engineer (£250) for the Bexley U.D.C. electricity and tramways department; stokers for the Derby Corporation electricity department; assistant mains engineer, draughtsman and clerk for sub-office for the Newcastle-on-Tyne Electric Supply Co., Ltd.; shift engineer (50s.) for the Tunbridge Wells Borough Council Electricity Works. See our advertisement pages to-day.

X-ray Apparatus.—Chelsea Hospital for Women has received £200 from Captain T. Sorby, who was recently a patient in the military section, towards providing an X-ray installation.—*The Times*.

Workmen's Compensation.—At Preston County Court, last week, his Honour Judge Sturges, K.C., approved of a settlement for £25 and costs in a compensation case in which the applicant was Robert R. Eccles, of Preston, and the respondents Messrs. Dick, Kerr & Co., Ltd., Preston.

In another case, Elizabeth Robinson, widow of the late Joseph Robinson, sought to recover compensation from Messrs. Dick, Kerr & Co., Ltd., for the loss of her husband. Whilst at work in December, 1916, the deceased felt a pain in his side, and did not return to work. After death a post-mortem examination revealed a large cancer behind the heart. Respondents denied liability, on the ground that death was due to disease, and not to an accident. It was common ground that an accident could not have caused the cancer, but the material point was whether or not it had accelerated death. To avoid an expensive trial, the respondents had agreed to pay £175, and costs. His Honour agreed.

The Electricity Committee of the Aberdeen Town Council reports having had under consideration the case of Thomas Fyfe, whose right eye was injured on June 9th last, while employed as an iron turner at the Ferryhill electricity station, and that a settlement has been made under the Workmen's Compensation Acts by a payment to the workman of £100.

Hull Station Engineers and the A.E.S.E.—On Feb. 6th, at the Manchester Hotel, Hull, under the chairmanship of Mr. Shankster, acting chief assistant at Sculcoates, a meeting of Hull electrical station engineers was held, and the following resolution was passed unanimously:—"That this meeting of Hull electrical station engineers, having in view the period of industrial and economic reconstruction after the war as foreshadowed in the Whitley Report and in that of the Coal Conservation Sub-Committee, considers that the interests of their profession can only be effectively represented by a powerful and united body elected from, and by, all grades of station engineers; this can, in its opinion, be best attained by all central-station engineers becoming members of the A.E.S.E." The persons present unanimously decided to form a local branch of the A.E.S.E., and in the meantime to apply to be attached to the Manchester Branch.

Business-Men's War Bonds Week.—Under the National War Savings Committee, the Aldwych Club is organising a Business Men's Week in connection with the War Bond Campaign. The date will be from March 4th to 9th. The object is set out in the following letter which has been issued to the Masters' Organisations throughout the country:—

> The National War Savings Committee has asked the co-operation of our Association in a matter of great importance to the country.
>
> A strenuous effort of business men to promote the sale of National War Bonds and War Savings Certificates is to be made during the first week in March.
>
> Employers of labour are asked to adopt an instalment plan (if they have not already done so) for the purchase of War Savings Certificates, which has been found to be so eminently successful.
>
> The hon. organiser asks every employer to arrange a meeting of his workpeople on Wednesday, March 6th, at 12 noon (11.45 where luncheon hour is fixed at noon).
>
> The urgency of the matter in relation to victory should be explained to the workpeople, and typewritten slips prepared beforehand should be handed round showing:—
>
> 1. The instalments which the employer is willing to accept.
> 2. Space for the amount of War Savings Certificates desired by the employe.
> 3. Space for the signature of the employé.
>
> If, therefore, the employés' investment in War Savings Certificates, added to the employer's own in National War Bonds, are registered on Thursday, March 7th, the enemy will learn the cause of the strange silence of our industries between 12 and 12.30 on the previous day.
>
> If you are able to co-operate in this scheme kindly let me know, so that I may forward your acquiescence to the National War Savings Committee.

Coke for London Consumers.—In view of the continuing supply of sufficient quantities of gas coke in the Metropolitan area, the Controller of Coal Mines announces that arrangements have now been completed by which consumers can obtain a quantity not exceeding 5 tons in any one case, in addition to the supply authorised under their requisition, or under a certificate in accordance with the terms of the Household Coal Distribution Order, 1917. Application must be made to the Local Coal Overseer of the district in which the consumer resides.

Institution and Lecture Notes.—Institution of Electrical Engineers (Birmingham Local Section).—The following are the arrangements for the remainder of the present session:—

February 20th.—C. C. Garrard, Ph.D., on "Switchgear Standardisation."
March 20th.—E. B. Wedmore, on "The Control of Large Amounts of Power."
April 17th.—E. C. McKinnon, on "Large Batteries for Power Purposes."

Institution of Electrical Engineers (Yorkshire Local Section).—On Tuesday evening Mr. E. C. McKinnon read a paper on "Large Batteries for Power Purposes."

Illuminating Engineering Society.—On Tuesday, February 26th, at 5 p.m., Lieut.-Commander Haydn T. Harrison, R.N.V.R., will read a paper on "A Survey of Methods of Directing and Concentrating Light."

Board of Trade Tramway Committee.—On Jan. 29th the recently-constituted Tramways Committee of the Board of Trade issued a circular letter to the tramway undertakings of the United Kingdom, setting forth its constitution and purpose, and asking for co-operation in forming Area Sub-Committees. The letter gave the names of the members of the Committee (of which Mr. James Devonshire is the chairman and Mr. James N. Wilson the secretary), the terms of reference, and the duties as laid down by the Board of Trade. The circular, which was signed by the secretary, then continued as follows :—

It will be apparent that the work involved is of great magnitude and of national importance, and the Committee has been giving very serious consideration to the machinery which it will set up for the purpose of carrying out the duties imposed upon it by the terms of reference.

For this purpose it has resolved to divide the country into nine areas which will be placed in four groups under Sub-Committees of the Committee to be termed "Area Sub-Committees."

The nine areas will be as follows :—

1. Metropolitan and East Coast.
2. South-East and South to Bournemouth.
3. South-West and South, excluding Bournemouth.
4. Midlands.
5. Lancashire, Cheshire, and Wales (North).
6. Yorkshire and Lincolnshire.
7. Northern.
8. Scotland.
9. Wales (South).

To assist the Area Sub-Committees in carrying out their investigations, it has been decided to invite representatives of the tramway undertakings in each area to act in a consultative capacity as Local Advisory Committees. As soon as possible, meetings will be arranged in convenient centres in each area to be attended by the members of the Area Sub-Committee concerned, when the scheme will be further explained.

I am, therefore, to inquire whether my Committee may rely on the co-operation of your Tramways Committee in giving effect to these proposals. Your friendly assistance will be much valued by my Committee, who will doubtless be confronted by many difficult problems in the discharge of the duties with which they have been entrusted.

There has been an immediate and favourable response from the tramway undertakings of the country. Already a large number of undertakings in important centres have signified their willingness to co-operate in forming the Area Sub-Committees, and in many other cases, although formal meetings of the Committees or Boards of Directors have not yet been held through lack of time, the chief executive officers have promised their active assistance.—*B. of T. Journal.*

Meetings have now been arranged at the following places on the dates mentioned :—Areas 1 and 2, London, February 27th ; 3, Bristol, February 26th ; 4, Birmingham, February 22nd ; 5, Liverpool, February 21st ; 6, York, February 20th ; 7, Newcastle, February 19th ; 8, Glasgow, February 18th ; 9, Cardiff, February 25th.

Two representatives, at least, of each tramway undertaking in other areas are invited to attend the local meetings for the purpose of appointing small local Advisory Committees. The precise time and place of the meetings will be communicated to them. The chairman will attend and speak at all the meetings.

The National Alliance of Employers and Employed.—Mr. F. Huth Jackson, at a meeting of this Alliance, said that with a view to preventing industrial disputes and increasing the efficiency of the industry of the country, Sub-Committees had been formed in many large centres, including Liverpool, Sheffield, Birmingham, Manchester, Cardiff, and Swansea. The movement was stated to be taking root in Leeds, Newcastle, Darlington, Edinburgh, and Glasgow.

Gas and Electric Co-operation.—In the course of his speech at the Gas Light and Coke Co.'s annual meeting, Mr. John Miles, the Governor, said :—

"I dare say many of you are aware that at present the question of the future supply of electricity in this country is being made the subject of inquiry by several Government Committees. This is a matter which is being watched by the directors, and we are of the opinion that there is no reason why there should not be co-operation between the gas and electricity industries, and we believe that such co-operation would be very much to the benefit of the public."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The salary of Mr. PURSE, borough electrical engineer at Carlisle, is to be increased at April 1st next from £500 to £600, with two further annual increments of £50, and the present bonus of 10 per cent. is to be discontinued. Mr. J. H. THOMPSON, the assistant electrical engineer, is to be advanced from £210 to £250.

Mr. F. [illegible], borough electrical engineer and tramways manager of Chesterfield, has been voted a war bonus [illegible] £[illegible]. The Council adopted a scheme under which a bonus of 15 per cent. is paid on salaries under £150, 10 per cent. on those from £150 to £250, and 7½ per cent. on those over £250.

Mr. J. S. HOLLINGRAKE, of the Ormskirk (Lancs.) Electricity Supply Co., has been appointed engineer-in-charge of the electricity department of Alloa Town Council.

The Exeter T.C. has granted £50, in recognition of his long service, to Mr. BARTLETT, who has resigned the position of tramway manager.

At a meeting of the St. Marylebone Borough Council, held last week, a resolution of the Electric Supply Committee was adopted placing on record high appreciation of the services rendered by Mr. E. J. JENNINGS to the electricity undertaking, [illegible] with an expression of its keen regret at losing his services. The resolution stated:—"During the 13 years Mr. Jennings has acted as secretary and accountant of the undertaking he has displayed a business capacity, a grasp of detail, and an imaginative insight that have been invaluable to the undertaking during many difficult years, while successive chairmen of the Committee have testified to his unfailing courtesy and untiring interest in his duties." Mr. Jennings was congratulated on his appointment to the post at Birmingham.

Mr. T. BLACKSHAW, who has been on the staff of the Blackburn Corporation electricity department for the last 12 years, has been appointed mains assistant with the Newcastle Electric Supply Co.

General.—The King has been pleased to approve of the appointment of Sir J. J. THOMSON, O.M., D.Sc., P.R.S., to be Master of Trinity College, Cambridge.

Mr. STUART EVANS, A.M.I.E.E., of Hoylake, late chief assistant engineer of the Lanarkshire Tramways, Scotland, has been released from the Ministry of Munitions (Trench Warfare Inspection Department) to take up more important work in connection with the Aeronautical Inspection Directorate.

Mr. J. F. LOAM, who has retired, after 36 years' service, from the staff of the Western Union Telegraph Co., Penzance, for whom he was assistant superintendent, has been presented by his colleagues with a large silver tray.

Roll of Honour.—The D.C.M. has been awarded to Sergeant W. M. SMART, Signal Section, R.E., formerly an engineer in the Swansea tramway depôt.

Wireless Telegraphist F. J. CALTON, of Southport, was lost by the foundering of H.M.S. *Opal* in a storm.

Captain J. H. LEE, London Regiment, formerly engaged at Rugby, with the B.T.H. Co., has been wounded in eight places, and is making good progress. Last summer he won the Military Cross.

Second-Lieutenant T. G. FRANCIS, who on receiving his commission has been posted to a Searchlight Section, to which he has been attached since joining the R.E. in December, 1914, is a son of Mr. T. Francis, and junior partner in the firm of Messrs. T. Francis & Sons, electrical engineers, Bolton.

Engineer S. STOCKS, E.R.A. and C.P.O., of H.M. Navy, is reported missing since the mining or torpedoing of three destroyers off the Dutch coast. Before volunteering he was employed at the Accrington Corporation electricity works. He was 31 years of age.

The *Times* records the death, which occurred on January 5th at the Naval Hospital, Philadelphia, U.S.A., from illness contracted while serving in France, of Chief Electrician JOHN GEORGE EGERTON, U.S.A. Naval Reserve, aged 26.

Private J. M'ADAM RITCHIE, officially reported killed in action, was employed by Messrs. Kelvin, Bottomley & Baird, Glasgow.

Lance-Corporal T. FISKEN, formerly employed in the cable department of the Post Office Telephones at Glasgow, has been awarded the Military Medal.

We have received a copy of the latest Roll of Service wall-sheet of Edmundson's Electricity Corporation, Ltd. It shows that at January 1st 500 employés from the associated undertakings had joined the Forces. Of these, 26 have made the supreme sacrifice, 13 have won decorations, including two D.S.O.'s, two D.C.M.'s, a D.S.M., and M.S.M. and seven Military Medals. Out of the 500 referred to, 256 have now seen service abroad or at sea.

NEW COMPANIES REGISTERED.

Electrical Supplies (Liverpool), Ltd. (149,569).—Private company. Registered February 8th. Capital, £2,000 in £1 shares. Electrical and mechanical engineers, manufacturers of and dealers in electric, magnetic, telegraphic, telephonic and other appliances, &c. The subscribers (each with one share) are:—J. B. Kenny, 47, Wellington Avenue, Liverpool, accountant's clerk; A. Lawson, 27, Stalbridge Avenue, Liverpool, accountant's clerk. The first directors are to be appointed by the subscribers. Qualification, 10 shares. Solicitor, H. T. Smith, 6, Newington, Liverpool.

Tubes (Equipment), Ltd. (149,544).—Private company. Registered February 5th. Capital, £1,000 in £1 shares. Manufacturers of and dealers in metal tubes, cycles, motors, aeroplanes, aircraft, and cycle and motor parts, electrical and general engineers, &c. The subscribers (each with one share) are:—J. H. Aston, Beech Hall, Wylde Green, manufacturer; A. Chamberlain, 39, Augustus Road, Edgbaston, manufacturer. The first directors are: J. H. Aston, A. Chamberlain, G. Beazly, A. E. Kirk, and J. R[illegible]. Solicitors: Pinsent & Co., Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sheerness and District Electric Power & Traction Co., Ltd.—Memorandum of satisfaction in full on January 1st, 1918, of 6 per cent. debentures dated February 12th, 1915, securing £200, has been filed.

Bastian Electric Co., Ltd.—Issue on January 21st, 1918, of £400 debentures, part of a series of which particulars have already been filed.

Lea Recorder Co., Ltd.—Mortgage dated February 1st, 1918, to secure £1,200, charged on land at Manchester and Stretford, with Burnside Cabinet Works thereon. Holder, Miss M. E. Guest, [illegible].

Banbury & District Electric Supply Co., Ltd.—Memorandum of satisfaction in full on December 31st, 1917, of debenture dated March 26th, 1913, securing £[illegible], has been filed.

CITY NOTES.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—Owing to the war, the accounts for the past year may not be received from Australia early enough to permit of holding the general meeting at the usual time in May. From information received it is calculated, says the *Financial Times*, that the net income will be nearly £4,000 below that received in 1916. This large decrease is mainly due to the shortage and the refractory attitude of labour, which, with other causes, prevented the mines from producing the usual tonnage of ore, thereby lessening the demand for electric current. There has also been a further increase in the cost of all supplies, which is another factor in lessening the profit for the year. These disadvantages have been most conspicuous during the last quarter, the cabled returns indicating a reduction in receipts of £1,400 compared with the corresponding period. In view of the smaller profit and of the arrangement entered into with the debenture holders to appropriate the first profits made during the current year, to the amount of £7,500, for a further repayment to them, the directors have decided that they will not be justified in paying the usual dividend to the preference shareholders in April next. It is hoped that when the obligations to the debenture holders have been provided for there will be a sufficient balance of profit remaining to enable the directors to recommend the payment of a dividend. The debenture debt has now been reduced to £30,000. It is expected that in four years the whole of this, which is the only prior charge, will be repaid.

Llandudno & Colwyn Bay Electric Railway, Ltd.—For the year ended November, 1917, the profit, after providing for expenses and debenture and loan interest, is £4,716, against £5,316 for 1916. Increased cost of labour and materials, decrease of holiday traffic, and other difficulties affected the net results. A dividend of 3 per cent .per annum, less income-tax, is to be paid, carrying forward £197. The sinking fund instalment, due January 1st, has been charged against the revenue for the year, and no further provision has been made for depreciation of the system.

Central Electric Supply Co.—After paying debenture interest, £20,636 is put to depreciation fund, £457 is written off discount on issue of debentures, and £16 is to be carried forward.

Hong-Kong Tramway Co., Ltd.—According to the *Financial Times*, a dividend of 14 per cent., less tax, is announced, making 23 per cent. for the year. £42,267 is carried forward.

City of Buenos Aires Tramways Co. (1904), Ltd.—The net revenue for the year ended December, 1917, was £67,670. Dividends amounting to 5 per cent. for the year, less income-tax, absorb £62,000, £5,600 is transferred to general amortisation fund, and £70 is carried forward.

Hill of Howth (Co. Dublin) Electric Tramway Co.—At the meeting, held in Dublin, a dividend of 3 per cent. per annum, with 1s. per share bonus, less tax, was declared.

National Gas Engine Co., Ltd.—The net profit for 1917, after providing for depreciation of buildings, plant, tools, &c., and allowing for management salaries, excess profits duty, and income-tax, is £103,136. An interim dividend of 7½ per cent. per annum on the ordinary shares was paid last July, and a further 7½ per cent., less income-tax, is to be paid, together with a bonus of 1s. per share, leaving £61,870 to be carried forward.

Telegraph Construction & Maintenance Co., Ltd.—In addition to 5 per cent. already paid, the directors recommend a dividend of 10 per cent., and a bonus of 12s. per share.

Newcastle-upon-Tyne Electric Co.—Final dividend, 5½ per cent. on ordinary shares, making 8 per cent. for the year.

Mather & Platt, Ltd.—Dividend on the ordinary shares, 17½ per cent. per annum, less tax.

South London Electric Supply Corporation, Ltd.—Dividend on ordinary shares at the rate of 5 per cent. per annum for the year 1917. £7,000 to depreciation fund; £2,500 to a reserve contingency fund; £3,150 to carry forward.

Crossley Bros., Ltd.—Dividend, 3½ per cent. on the ordinary shares, making 6 per cent. for the year

London & Suburban Traction Co., Ltd.—The accounts cannot be completed before the date for paying the preference dividend, but a notice respecting that dividend will be issued as soon as possible after that date (February 15th).

STOCKS AND SHARES

Tuesday Evening.

The brightness which came over many of the markets last week has been tempered, or overclouded, by the latest developments in Russia. That Russia would make peace all along the lines came as something of a surprise as well as a disappointment. It had the effect of checking business, of inducing heaviness in Consols, and in most of the investment stocks. Industrials, however, keep decidedly hard, the argument in their favour being that depression in gilt-edged stocks is rather a bull point, if anything, for others which give a larger return upon the money, and which are likely to be sought by the taxpayer who finds it necessary to increase his income by the investment of money in higher-yielding shares than those which he would have been willing to buy in the past.

The home railway market has suffered a grievous disappointment in the disappearance of the little burst of buoyancy experience a week or ten days ago. Dividends are good, appropriations in most cases better than those of last year, and statements at some of the meetings have been encouraging. Other chairmen's speeches, however, leaned to the pessimistic view, and, in consequence, the satisfaction of the buying movement which put prices up was followed by a general drop in values as soon as the support was withdrawn, and it became obvious how much stock lay in wait for a reasonably good chance of realisation.

The Underground group has declared dividends which are fairly good, though there is nothing much to boast about in any of the announcements. The principal one, of course, is that of the Underground Electric Railways Co. of London. The company has declared 4 per cent., free of tax, on the Income Bonds, carrying forward £31,000, whereas for 1916 the bonds received 5 per cent., also free of tax, and the carry-forward was £30,000. The reduction may be due in some measure to the London General Omnibus paying 7 per cent. for the year instead of 8 per cent., the carry-forward in the latter case being £38,500, an increase of £17,000 as compared with 1916. The City & South London Ordinary stock receives 1½ per cent. for 1917, London Electric Ordinary the same, Central London Deferred 3 per cent., while the District Co. pays in full down to the 5 per cent. on the Second Preference, which gets 3 per cent. for 1917. These dividends are identical with those of a year ago, but the amounts carried forward are all improved, with the exception of the Central London, where this year's £11,000 is about £1,000 less than it was in the previous period. The only change in prices is a fall of ½ in Underground Incomes to 81, but the aspect of the market as a whole is dull and heavy, much to the disgust of those who had looked for better things as the result of the dividend declarations and reports.

One of the sensations in the miscellaneous market has been a rise to 4⅛ in the price of Oriental Telephones, due, of course, to the acquisition by the Egyptian Government of that part of the Oriental's undertaking which is situated in Egypt. The price to be paid is a good one, and the market estimate for Oriental Telephone shares is that they should be worth 5. Marconis are also a better market, although in the parent shares there is not much going on. Americans command principal interest with a rise to 25s. 6d., while Canadians and Marines are also better. The telegraph and cable markets are steady as a whole, with still a pronounced shortage of supply. India-Rubbers, although nominally quoted 14¾ middle, can be sold at a higher price than this, and the same condition applies to various others of the high-priced shares in the manufacturing group. Telephone of Egypt 4½ per cent. debenture is 11½ up at 102½. The stock is redeemable at 100 in 1954, but at 107½ if it is repaid earlier in certain circumstances.

Activity continues to prevail amongst electrical manufacturing issues, and, although the best prices are scarcely maintained, there remains considerable optimism and expectations of further rises taking place. It seems to some, however, that the advances, such, for instance, as those in the Edison Swan shares, have already been sufficiently considerable to make a reaction not so unlikely, but, in spite of this, the provinces kept on buying shares, and Edison Swan "little ones," as they are called in the market, have improved to 33s. 6d. Crompton ordinary are wanted at 16s., and the preference at 17s. General Electric ordinary gained 5s. at 19¼. Electric Constructions are 1/32 lower. India-Rubber preference at 8 have gained 5s.

Electric lighting shares are firm, and City of London Ordinary can be sold at the middle price of 13¼; possibly more might be obtained. Westminsters have risen to 7. Notting Hill ordinary are strong at 33s. 6d. South Metropolitan ordinary have jumped to 40s. The last recorded business in them was at 21s. [illegible] two months ago. The [illegible] first preference are 21[illegible] and the [illegible] toria Falls ordinary keep an active market around 18s., while the preference are 23s., and the second debentures 105.

Foreigners are quiet. Nothing new has developed in Mexicans. Brazilian Tractions put on ½. British Columbia Electric preference gained 3 points, and the deferred 1. Iron and steel shares are uniformly good; armaments sympathetically advanced. Rubber issues rallied on a recovery in the produce. Base-metal descriptions present a good appearance.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Feb. 13, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3⅜	—	6 13 4
Chelsea	4	8	2⅝	—	5 4 4
City of London	8	8	18½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 5 10
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	5⅜	—	5 18 6
Metropolitan	8	8	8½	—	4 12 1
do. 4½ per cent. Pref.	4½	4½	8¾	—	6 13 4
St. James' and Pall Mall ..	8	8	7¼	—	5 10 1
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	7	+ ⅛	6 8 7
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94¼xd	—	6 7 0
do. Def.	83/6	1½	22⅜	+ ½	6 13 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 1
Eastern Extension	8	8	15⅛	—	*5 6 0
Eastern Tel. Ord.	8	8	151½	—	*5 5 7
Globe Tel. and T. Ord.	7	7	14⅛	—	*4 19 1
do. Pref. ..	6	6	10⅛	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	10	15	3⅛	+ 1/16	4 16 1
Oriental Telephone Ord. ..	10	10	4 1/16	+ 1/16	2 19 3
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan.	6d.	6d.	1 1/16	—	*2 15 2
Western Telegraph	7	8	15½	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	64½	—	6 4 0
Metropolitan	1	1	22½	—	4 9 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	81	— ½	*4 18 9
Foreign Trams, &c.	**Dividend 1915.**	**1916**			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	45	+ ½	—
Bombay Electric Pref.	6	6	9¼xd	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	46	+3	10 17 4
do. do. Preferred	Nil	Nil	29½	—	Nil
do. do. Deferred	Nil	Nil	29	+1	Nil
do. do. Deb.	4½	4½	63	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	32½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	—	4 12 4
British Aluminium Ord. ..	7	10	1 7/32	—	8 0 9
British Insulated Ord.	17½	20	3½	—	5 14 4
British Westinghouse Pref. ..	7½	7½	2 3/16	—	5 6 9
Callenders	20	20	15	—	6 13 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 9/16	—	5 12 2
Edison Swan, fully paid ..	—	—	2⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75*	—	5 6 0
Electric Construction	7½	7½	1 7/32	— ½	6 16 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19¼	+ ¼	5 4 0
Henley	25	25	17	—	7 7 1
do. 4½ Pref.	4½	4½	4	—	5 12 2
India-Rubber	10	10	14¾	—	*6 15 7
Telegraph Con.	20	20	42	—	*5 14 3

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	£	No. of weeks.	Total to date. £	£	Route miles open.	Inc.
Bristol								
Cork	Dec. 31	7,934	+ 974	4	7,934	+ 974	..	..
Dublin	Jan. 25	24,947	+ 3,192	4	24,947	+ 3,192	..	..
Hastings	,, 28	3,616	— 96	4	3,616	— 96	..	..
Lancashire United	,, 30	9,404	+ 2,625	4	10,328	+ 2,746	..	..
Llandudno-Col. Bay	,, 25	855	+ 114	8	1,784	+ 222	..	..
Anglo-Argentine ..	,, 28	49,151	+ 10,46	4	49,151	+ 10,465	..	..
Auckland	Oct. 26	[illegible]	+ 850	17	92,118	+ 7,822	..	..
Calcutta	,, 26	18,477	+ 221	4	18,477	+ 221	..	..
Kalgoorlie, W.A. ..	Sept.	3,083		34	24,128	..	..	..
Madras	,, 31	[illegible]	+ 31	4	5,218	+ 31	..	..
Montevideo ..	Jan.	[illegible]	2,675	1	101,101	[illegible]	..	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£58	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£38	..
a Copper Sulphate	,,	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£18 15/-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/-	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/6¾ to 1/7¼	..
g ,, Bars (best selected) ..	per ton	£117	..
g ,, Sheet	,,	£147	..
g ,, Rod	,,	£147	..
d ,, (Electrolytic) Bars ..	,,	£125	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods	,,	£133	..
d ,, ,, H.C. Wire	per lb.	1/3⅞	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	2/6¾	1d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	4/1	1d. inc.

Quotations supplied by—

a G. Boor & Co.	*g* James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	*h* Edward Till & Co.
d Frederick Smith & Co.	*i* Bolling & Lowe.
e F. Wiggins & Sons.	*l* Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*n* P. Ormiston & Sons.
	r W. F. Dennis & Co.

Electro-Metallurgy in France.—A further instance of the war-time utilisation of electricity in connection with French iron and steel works is afforded by the Société Métallurgique de l'Ariège. According to the directors' report for 1916-17, the company started the first electric furnace at the temporary Saint Antoine works last May, and completed two other similar furnaces in July. The production comprises certain classes of pig-iron, which is in great demand for war purposes, and which it is difficult to make in blast furnaces. At present the erection of a power transmission line from Saint Antoine to Crampagna is being prepared, so that the former may render assistance to the Pamiers works during the several weeks of drought in August and September. The operation of the Crampagna works and that of Las Rives has been normal, and the power produced has been particularly useful to the Pamiers works. Last September the work of utilising the fall of Las Mijanes was commenced, and this will be able to yield 2,500 H.P. during the average level of the water. The majority of the shares has been acquired in the Société Hydro-Electrique des Pyrénées, which possesses a works at Castelet, on the Ariège, supplied from a fall and comprising four electric furnaces, each served by a generating set of 800 H.P. The latter company also owns a second fall formed by the Nagear torrent, capable of being equipped to produce 1,500 H.P. At present the Castelet works turns out carbide of calcium, but the controlling company foresees the future importance of a new source capable of affording 5,000 H.P. Concerning the Pamiers works, the report states that the new programme in hand comprises the construction of two open-hearth steel furnaces, each of a capacity of from 20 to 25 tons, and of a blooming mill as intermediary between the steel works and the rolling mills. All the apparatus will be driven by electric power, and the first furnace will be ready in May and the second by the end of the present year.

Notes from Spain.—Our Spanish correspondent writes:—

Coruna.—A company has been formed to establish iron blast furnaces in Monforte. The necessary power will be obtained at hydro-electric plants situated at various waterfalls on the River Sil.

Barcelona.—The recent labour troubles caused by high prices and unemployment due to shortage of coal and motive power, have not affected the district of Olesa, where the supply authorities reduced the price of electric current a short time ago.

ROLLING MILLS AND THE ELECTRIC DRIVE.

By L. ROTHERA, B.Sc., A.M.Inst.C.E

(*Abstract of paper read before the* Manchester Association of Engineers.)

The first mill driven by electric motors was set to work in 1890 in Sweden, and this example was rapidly followed on the Continent. It was not until 1904 that the first large equipment was installed here, this being at the works of the English McKenna Process Co., where a rail mill was equipped with six 500-h.p. motors. Since that date such drives have been put down at a constantly accelerating pace.

The continually increasing demand on the output of our steel and metal works due to the war necessitated, in many instances, a reorganisation and extension of a large number of plants, and the recognition of the electric drive as the best method of modernising the same has been very widespread; at the moment the rate at which this form of drive is being adopted is limited only by the capacity of the country to manufacture the necessary plant.

The power installed in our steel and metal works is now well in excess of 300,000 h.p., and the fact that this represents only a very small percentage of the total power employed in these industries gives a measure of the importance of the subject.

Taking mills with heavy reversing duty, whilst in 1914 only four such electric drives were in operation, of which two were of comparatively small size, since that date no fewer than nine equipments have been put in hand, with powers at the mill ranging up to 20,000 h.p., and a further number would have been installed had it been permitted.

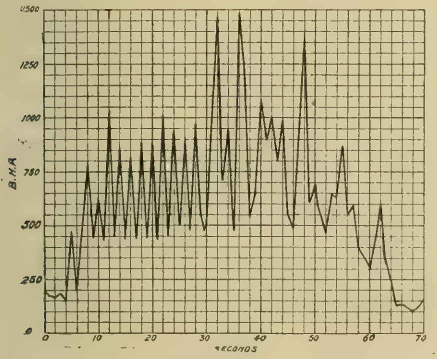


Fig. 1.

In figs. 1, 2, and 3 respectively are shown the form of power demand in the case of a heavy sheet mill, a wire rod mill, and a section mill rolling joists. A very wide series of equipments have satisfactorily and efficently met the varying demands, and proved the entire adaptability of the electric motor to meet the most arduous conditions.

The advantages which can be claimed for the electric drive are:—

1. *Economy of Working, i.e.*, reduction in cost per ton of material rolled. This results from a number of causes, such as the great rapidity of working and high efficiency of the electric plant at all loads, from light load to the maximum permissible overload. This economy of working persists throughout the whole life of the plant, as electrical machinery maintains its efficiency unimpaired independently of the time during which it has been at work.

2. *Reduced Space Taken Up.*—Partly on account of the small size of a motor as compared with its output, and partly due to the possibility of placing the motor in the most convenient position, without having to consider the run of steam pipes or the relative position of the boiler-house.

3. *Ease of Control*, such as stopping, starting, or varying the speed of the drive.

4. *Constant Check on the Power Consumed.*—A recording instrument gives immediate information as to an undue consumption of power, thus enabling adverse circumstances to be promptly noticed and remedied.

5. *Increased Output from a Given Plant.*—This results from the large overload capacity and constant speed of the electric motor under all conditions of load.

6. *More Uniform Drive.*—The turning moment of a motor is constant for any position of the rotor, whereas a steam engine's turning moment fluctuates, depending on the position of the cranks.

7. *Smaller Initial Cost.*—This is particularly the case where electric power is available from a neighbouring central station and, on the other hand, boilers would be required in the event of a new steam engine being put down.

There is a very large number of additional advantages, such as the cleanliness of the drive, the small cost of upkeep, reduction in oil consumption, information easily available as to the actual demand on the prime mover for varying classes of material and draughts, &c.

An equipment for tin-bar rolling, designed to deal with 40 tons per hour of tin bars 12 lb. per foot, originally consisted of two stands of housings, one cogging and one finishing, both three-high. It was decided to retain the existing three-high cogging mill, but to re-model the finishing mill, making this into a two-high reversing mill.

A power company some eight or nine miles away was in a position to supply the necessary power, and erected an overhead transmission line for the purpose. This conveyed the power at 11,000 volts, 25 cycles, 3-phase, into the works, where transformers reduced the pressure to 2,750 volts, at which voltage the large main motors were designed to operate.

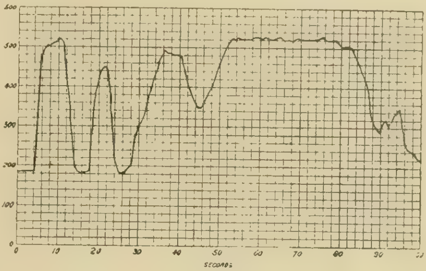


Fig. 2.

For the drive of the 27-in. three-high cogging rolls a 700-h.p. 3-phase motor was coupled to the flywheel which formed part of the old engine drive, a flexible coupling being inserted between the motor and the flywheel, which weighs about 50 tons, and is 12 ft. in diameter. A continuous-running motor with a speed of about 70 r.p.m. was chosen; a slip resistance permanently connected in the rotor gives a fall in speed between light load and full load for the purpose of rendering a portion of the flywheel energy available during the passes, and at the same time giving a somewhat slower speed when the metal is actually in the rolls.

The 30-in. reversing finishing mill represents a distinct departure, and is the first mill in this country rolling out tin bars to be driven by an electric reversing motor. The motor is of specially heavy design throughout, to meet the severe duty, and all parts subject to special stress, such as the armature core centre, the commutator tubes, and frames, are of cast steel, while special compensating windings are added to the field system to ensure good commutation.

The motor is designed to give a maximum peak horse-power of 5,300, and is direct coupled to the mill, the speed being variable in either direction between 0 and 180 r.p.m. A forced draught is blown into the machine by means of a motor-driven fan, to produce the necessary cooling, and a filter cleans the air before it reaches the motor.

The maintenance of a steady demand from the supply in place of the rapidly recurring peaks called for by the mill, which may exceed 20,000 h.p., and the reversal, in a simple manner, of a mill motor, the rotating portion of which may weigh up to 120 tons, are accomplished by the introduction of a motor-generator flywheel set, the flywheel acting as a reservoir of energy. The motor driving the flywheel is calculated on the average load taken by the mill over a period, and may be of ¼ or even ⅛ of the h.p. of the mill motor, depending on the class of work being done.

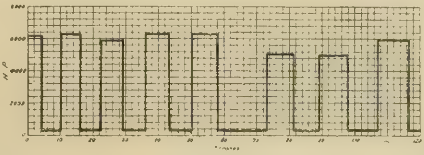


Fig. 3.

The reversal of the motor is done by altering the direction of the current supplied to its armature by the generator of the flywheel set, the control of the latter being done by varying its field current in strength and direction. Thus no armature currents, which may exceed 8,000 amperes, need be controlled.

The operator for the mill is on a platform raised over the live roll track on the incoming side of the mill, and the whole of the control of the speed and direction of rotation of the mill motor is done by means of a lever moving in a straight slot. The centre position of the lever corresponds to a state at rest on the motor, and a forward or backward movement gives a rotation in the one direction or the reverse.

Each position of the lever corresponds to a definite speed on the mill motor, independently of the power being given. Thus, under no circumstances can the speed of the motor exceed the maximum for which it is designed, and the racing so noticeable with a steam engine when the metal leaves the rolls is entirely avoided, and the attendant stresses produced are eliminated.

The stored energy in the rotating parts of the motor is, on reversal, not wasted as in the case of an engine, but restored to the flywheel, and thus rendered available for the next pass.

The function of the control lever is to vary the field currents of a small motor-generator set embodying two generators, the armature output of which is used for exciting the fields of the variable voltage generator and the mill motor respectively. With the control lever in the central position, the field current in the exciter supplying the variable voltage generator is at zero, whilst the field current in the exciter supplying the mill motor is a maximum. Thus the mill motor is fully excited whilst the variable-voltage generator is at zero voltage. A forward or backward movement of the lever serves to raise the voltage on the generator supplying the mill-motor armature by acting on its exciter, and the speed of the motor corresponds to the voltage thus applied and its direction of rotation to the sign of the voltage. This raising of the voltage continues until the maximum speed is reached, at which the full torque is required, after which a further movement of the lever weakens the mill-motor field through its exciter, and the speed of the motor increases to its maximum value. Constant horse-power, that is, reducing torque with increasing speed, is given throughout the latter portion of the speed range.

Fig. 4 shows in skeleton the diagram of connections for the plant, E 1 and E 2 representing exciters of the V.V. generator G and mill motor M respectively; C is the main controller.

This method of control is very simple, as the only currents to be controlled are those flowing in the fields of the small exciters. The controller itself is consequently of very small dimensions, and takes a form not widely different from the well-known faceplate type crane controller. In earlier plants the control was carried out by varying the fields of the mill motor and variable voltage generator themselves, but this entailed the use of a somewhat complicated contactor gear, which is avoided under this later arrangement.

The flywheel motor-generator set consists of an 1,800-H.P. 3 phase induction motor, a 30-ton 12-ft. flywheel, and the variable-voltage generator, the working speed varying between 500 and 390 R.P.M.

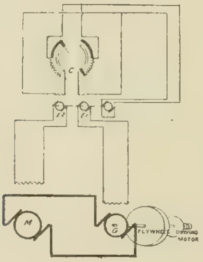


Fig. 4.

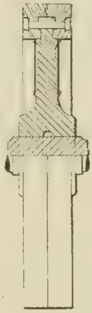


Fig. 5.

To keep the weight of the wheel a minimum whilst embodying at the same time a large stored energy (the value of this being 100,000 H.P.-seconds), it is necessary to use a flywheel with a very high peripheral speed, of the order of 20,000 ft. a minute.

In the case of a solid steel casting there is always a difficulty of eliminating internal strains, and the consequent uncertainty as to the actual stress occurring in the wheel at such high speeds. To ensure avoidance of this trouble a built-up wheel, consisting of a central steel spider with arms, and two complete cast steel rings bolted on to the periphery, was designed.

Fig. 5 shows a cross-section of the wheel, which indicates the method of bolting up. This design lends itself very easily to perfect balancing, which is essential for satisfactory running, an out-of-balance on the rim of 1 lb. exerting a pull equal to 500 lb. To reduce the windage losses to a minimum, the sides of the spider are enclosed by polished steel plates, and a cover surrounds the outer rim of the wheel for the same purpose. Running the flywheels *in vacuo* was tried, but more power was used in maintaining the vacuum than was saved by adopting this practice.

For lubricating the flywheel bearings, oil at a pressure of about 300 lb. to the square inch is forced in under the shaft by means of small gear pumps, one for each bearing. Oil rings are also provided, which keep the plant running for a short time in the event of the failure of the forced lubrication.

The interchange of power from and to the flywheel is brought about by means of an automatic slip regulator. This consists of a water resistance, the value of which is altered by raising and lowering suitably shaped metal plates in the tanks containing the water. The movement of the plates is brought about by a so-called torque motor. This machine is similar to an ordinary induction motor, but the rotor is prevented from moving by the restraining force of the plates. The weight of these serves to counter-balance the tendency of the rotor to move at such times as the normal current is being taken by the motor driving the flywheel set. When a piece of metal enters the rolls there is a heavy demand for power from the flywheel set generator, which power would, under ordinary circumstances, be reflected in the power given by the motor driving it. In the present instance, however, as soon as the current taken by the motor tends to rise, the torque motor, which is controlled by this current, exerts a larger turning moment and raises the plates, thus inserting an increased resistance in the rotor of the driving motor, which consequently falls in speed, and the make-up power between the demand of the mill and the normal power of the motor driving the flywheel set is given out by the flywheel. When the metal leaves the rolls the demand from the mill immediately falls below the normal, and the reverse action takes place; the weight of the plates overcomes the torque of the motor, and they are lowered into the liquid, thus reducing the resistance in the rotor, and the motor speeds up, restoring energy in the flywheel. A speed variation of 20 per cent. is usually allowed on the flywheel set, thus rendering available for useful work 36 per cent. of the total stored energy of the flywheel.

The torque motor is operated by a series transformer mounted in the cable connections leading to the motor of the flywheel set, and by tappings on this transformer a simple adjustment varies the power taken by the motor. This is of service when rolling lighter material, as the average demand from the power station can be reduced proportionally, and in the case of the plant in question, one-half the normal power has successfully been used on certain classes of material.

Mounted alongside the control lever is an instrument pillar which serves to give the driver full information as to the operation of the complete set. An ammeter indicates the power being given at any moment by the mill motor, whilst an indicator simultaneously gives the speed at which this motor is revolving. Three lamps which light up at different speeds of the flywheel set give information as to the reserve power in the flywheel, and if the lamp corresponding to the lower working limit of the set comes in, it is necessary to roll slowly until such time as the flywheel set has regained its speed, as otherwise the mill demand would be reflected on the supply, and the driving motor would be overloaded.

Simultaneously with the installation of the above main drive, the live roller gear was re-designed and driven by reversing motors, this completing the electrical drive through the works, the conversion of the auxiliary machinery having previously been carried out.

A 7-in. wire rod mill, with an output of 3½ tons per hour, was originally driven by steam engines. It was shown that by putting down turbine plant driving electrical generators, a large quantity of coal would be saved.

The mill, as can be seen from fig. 6, consists of two sets of rolls, the bolting and finishing rolls respectively; the bolting rolls are of the double two-high type with repeaters behind the rolls; the finishing train is three-high, and the wire is looped by hand.

The drive represented the first example of a wire mill to be electrically driven in this country. The motors installed were of 400 H.P. for the bolting rolls and 550 H.P. for the finishing rolls. The generating plant was designed for an output of 750 KW. at 440 volts D.C., the turbine being of the mixed-pressure type.

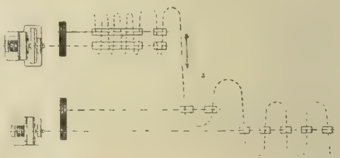


Fig. 6.

The incoming billet for the bolting rolls is about 2 in. square, and leaves this train of rolls with an area of about ½ sq. in. This passes straight forward to the finishing rolls, and as many as 10 passes may be occurring simultaneously. The normal size of rod finished is about 3/16 in. diameter.

The 2 in. billet enters the bolting rolls with a length of about 3 ft., and heavy draughts are taken on the first few passes, resulting in short but heavy peak loads. The average demand for power throughout this period is comparatively small, and the motor is designed from the point of view of the average demand rather than the peak demand. The difference in power between the average demand and the peak demand is obtained from a cast-steel flywheel about 15 tons in weight, and 12 ft. 6 in. in diameter. The armature of the motor was mounted directly alongside the flywheel, and the whole supported by two solid bearings carried on an all-round bedplate.

The motor, to meet the varying classes of work, was designed with a speed range between 190 and 270 R.P.M. at full load, and a compound winding automatically gives a fall in speed from no load to full load, so that the energy stored in the flywheel may be utilised.

To ensure good commutation under all conditions of load, a compensating winding is added to the field to neutralise the heavy armature reaction which occurs on peak loads.

A diverter mounted on the frame of the machine is used for shunting a portion of the current flowing round the compound winding, and enables the fall in speed between no load and full load to be adjusted at will.

The finishing mill motor is also of the variable-speed type, the range being 400 to 500 R.P.M. at full load. No flywheel was employed in this case, as the peak loads, owing to the long length of material rolled, persist for an appreciable period, and an equalising effect could only be obtained by having a flywheel of a weight which would prove a non-commercial proposition.

The results obtained from this drive were so satisfactory that the conversion of the remaining plant has been proceeding steadily since that date, and three additional motor drives have been installed.

The mills in question are engaged on general merchant work, which from its variety, necessitates, for efficient rolling, a wide range of speed on the motor. This, in turn, renders the employment of direct-current motors almost obligatory, and for this reason the generating plant was of the direct-current type.

It may be stated generally that direct-current motors have proved themselves more suitable than 3-phase motors over a wider range of work, and for steel works practice it would appear as though such motors would be the more widely adopted in the future.

A new mill for rolling sheets for corrugating and other purposes, output 30 tons per shift, was arranged for an electric drive throughout. The main rolling-mill plant consists of four stands of rolls, two stands being placed on each side of a centre flywheel, which has a grooved periphery for taking 22 2-in. driving ropes, is 30 ft. in diameter, and weighs approximately 104 tons. The rolls are 32 in. in diameter, and run at a top speed of about 35 R.P.M.

The motor, which is of the 3-phase induction type, is designed for a normal power of 1,060 H.P., and runs at a speed of 200 R.P.M. A flexible coupling of the interlaced leather belt type connects the motor shaft to the rope pulley, which is approximately of 5 ft. 3 in. diameter. For sheet rolling a constant speed at the mill is required, so that there is no necessity to adopt a form of drive which allows for speed regulation beyond the necessary fall in speed from no load to full load to enable the flywheel to equalise out the peaks. A 3-phase motor consequently proved quite suitable, and an automatic fall in speed of 15 per cent. between no load and full load was produced by a permanent resistance in the rotor of the motor. The type of mill demand when engaged on this material is as shown in fig. 1, and even the interposition of a flywheel of the weight mentioned above only produces a partial equalising effect; the motors are frequently called upon to withstand overloads varying between 50 per cent. and 75 per cent. above normal.

The whole of the auxiliaries, such as shears, plate flatteners, corrugating machines, &c., were driven by small motors.

The author thanks Messrs. Siemens Bros. Dynamo Works, Ltd., for permitting him to publish the illustrations and show the lantern slides which accompany the paper.

KELVIN AS A TEACHER.

On Thursday last week the ninth Kelvin Lecture was delivered before the Institution of Electrical Engineers by Prof. Magnus Maclean, D.Sc., M.I.E.E., who during the 15 years he acted as Lord Kelvin's chief official assistant, attended every lecture he delivered, and took for the main theme of his address the subject named above.

There was no systematic course of instruction in the laboratory. A number of Thomson's scholars were always engaged in experimental research, and new students were attached singly or in pairs to each scholar, and had to help in making observations and devising new apparatus. In this way students got practice in woodwork, sawing, planing, and fitting. Nothing was done for them. If a student had to solder, he was required to do it himself, and with resin, no chloride of zinc being allowed. True, he had an opportunity of seeing how it was done by a senior student or scholar while he was at the stage of looking on and helping. But Kelvin's attitude to beginners is quite explicitly enunciated in his remark in a letter to the author: "Let any students, if there be any, stand by and learn, and help when they can." Kelvin's method, or want of method, had many disadvantages, but the more modern methods prevalent in every British laboratory are by no means free from defects also.

He was quick in temper, as in mind. Little mishaps, or an apparent want of economy on the part of a student, often sent the great scientist into a paroxysm of passion.

Incidents of this kind stand out prominently in the author's experience while assistant. It had been one of his duties, in conjunction with the mechanic, to prepare the previous afternoon all the experiments deemed necessary for the lecture next morning This frequently involved hours of work. But, alas! next morning an unanswered question by a student in the oral examination set the lecturer off at a tangent to discuss subjects quite different from those that were to be illustrated by the experiments prepared. This was no uncommon occurrence, and very irritating to the one whose labour was wasted.

Towards the end of his first session the author had a violent altercation with him over a trifling mishap; from that time their relations became more cordial, and instead of asking for dozens of experiments to be got ready for him, he would look in during the afternoon and ask what had been got ready.

In 1901 the author read a paper on "Kelvin's Electric Measuring Instruments." It is noteworthy that a considerable number of the instruments described and illustrated in the 1901 paper are not now being manufactured. Those which are still manufactured have been subject to continual improvement of detail and arrangement to meet the varying conditions of practical use and manufacture, but the basic principles as laid down by Lord Kelvin are maintained in their design.

The ampere balances have been modified in detail, in view of their extended use on alternating-current circuits.

The watt-balances have been for some time in process of complete re-design, so as to reduce the possibility of error due to eddy currents in the main conductors and metal parts of the instruments in the neighbourhood of the coils. Those dealing with large currents employ concentric main conductors, by which errors due to eddy currents and skin effects are eliminated and a robust construction is retained. These are being manufactured in collaboration with Mr. A. E. Moore.

In the multicellular voltmeters the casings are insulated on the outside surface, thus providing safety while maintaining efficient screening. By the use of non-inductive resistances with suitable tappings for multipliers, multirange instruments of various kinds are available.

The rail-bond testing instruments now make use of the bridge method, and the indicating instrument is a moving-coil galvanometer. The contacts applied to the rails are similar to those in the older instrument, but are at a fixed distance apart and are constructed in hardened steel with cutting edges to effect efficient contact on the rail surface. The present instrument is much lighter than the earlier pattern described in the 1901 paper.

Recording ammeters and voltmeters, and feeder logs: for direct-current work the moving-coil type of instrument is now invariably used instead of the older coil-and-plunger pattern. The use of the moving-coil instrument enables large currents to be dealt with by means of shunts, and also admits of the instruments being standardised as to sensibility.

The coil-and-plunger pattern ampere gauge has also been replaced by the moving-coil type of instrument for direct-current work. A new pattern "moving-iron" instrument is manufactured for alternating-current work, in which the form of, and the flux density in, the moving iron are so arranged that large changes of frequency or of wave-form are practically without effect on the instrument. They are damped pneumatically instead of by an oil dash-pot, and are thus more portable.

The portable indicating wattmeters have a minimum of metal near the active coils, and that metal is of very high specific resistance. This eliminates eddy-current errors for all practical purposes. The whole of the movement and the fixed coils are rigidly carried on a base casting which is machined out in order to form the damping chamber, in which chamber there move two light vanes attached to the movement spindle. The instrument can be arranged for voltages up to about 500, and by means of change-over links on the current terminals two ranges can be obtained by putting the main coils in series or in parallel. The main coils for large currents are wound with stranded conductor, each strand of which is insulated from its neighbours.

The author gives a selection from a great number of letters received from Lord Kelvin from 1886 onwards. They refer to the experiments that were going on in the laboratory at the time, or to the calculations that were being made for one or other of his papers. Two of these are given in fac-simile.

He had always thought of Kelvin as one of the most gifted and successful of mankind alike in his early distinction, the length and brilliance of his career, his wonderful genius, and the uniform physical health, which enabled him to carry on his work, so that almost to the end it might be said that his eye was not dimmed nor his natural strength abated. What was even more astonishing, his zest for research and his interest in all the complicated problems of the material universe never waned. He seemed to live to wrest from Nature her secrets, and it gave one pleasure to consider how much richer the world was to-day through the efforts of his giant intellect. Unlike the work of many another brilliant man, his success could not in any sense be regarded as ephemeral, for his achievements were interwoven into the fabric of scientific progress which shall continue to help and push forward mankind.

THE RONTGEN SOCIETY.

AT the meeting of the Rontgen Society, on February 5th, DR. G. B. BATTEN gave a demonstration of a simple means which he has introduced for obtaining static effects in treatment from an induction coil. The coil which he found to work best was one of large voltage and small milliamperage, and he used in conjunction with it a condenser purely to serve as a resistance. The disadvantage of the coil was that, in comparison with the ordinary static machine, its milliamperage was so considerable. With the static machine one got up to 800,000 or a million volts with very little milliamperage at all. With his present coil he did not pretend that he could get more than 100,000 volts at the best, but it was purely a question of getting a coil built so as to give a very high voltage, and then one would hardly have to cut down the milliamperage by the condenser at all. Even with this machine he found that for the static bath treatment he could cut out the condenser altogether, but care had to be taken that there was no spark, otherwise the effect was too great. He could not get the static breeze effect at all satisfactorily, but he thought that this was purely a question of increasing the voltage by a suitably wound coil. He was able to get tetanic contractions by very rapid interruptions, and by running the apparatus very fast indeed he got also tissue contractions quite well. In the case of one lady who had been cured of an occupation-neuritis by his static applications, what were produced in the first instance by the use of the current were not muscle, but tissue or tetanic contractions. He hoped that the arrangement would do something to overcome the difficulties occasioned by the climate, which were such a bugbear in the use of the ordinary static machine.

CAPT. G. W. C. KAYE thought it very dangerous to draw a distinction between static electricity and faradic electricity. There was no distinction at all from the physical point of view. In the one case there were rather higher voltages than in the other, but it was only a question of relative amounts. Personally, he would like to see both terms abolished.

DR. E. P. CUMBERBATCH said that while the modern coil used for X-ray work had not enough voltage and too high a milliamperage for static purposes, it would be possible to wind a transformer of thick wire on the secondary for the purpose of getting a sufficiently high voltage, and if one could get a spark 12 in. long with such an arrangement, it would be much cheaper than the modern American static machine, which cost in pre-war times £200, and now, perhaps, cost £230 or £240, and was very difficult to use, owing to the dampness of the climate.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,577. "Locking device for electric lampholders." M. ARCHER & J. BEIN. January 28th.

1,620. "Electric machines." H. PIEPER. January 28th.

1,621. "Starting apparatus for internal-combustion engines, &c." A. I. ODIER. January 28th.

1,626. "Glands and stuffing-boxes for electric cables." A. C. PURDAY. January 28th.

1,627/1,632. "Dynamo-electric machines." SUBMERSIBLE & J-L. MOTORS, LTD., & H. K. WHITEHORN. January 28th.

1,634. "Device for regulating voltage of current generated by a dynamo." R. BOSCH AKT. GES. January 28th. (Germany, January 26th, 1917.)

1,638. "Sparking plugs for internal-combustion engines." V. PERRETT. January 28th.

1,686. "Electric storage battery-charging systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) January 29th.

1,687. "Dynamo-electric machines." D. SUCHOSTAWER. January 29th.

1,690. "Dynamo-electric machines." G. A. JUHLIN & J. S. PECK. January 29th.

1,697. "Electric ignition apparatus for internal-combustion engines." AKT. GES. BROWN, BOVERI ET CIE. January 29th. (Germany, February 13th, 1917.)

1,728. "Means for enhancing radiation or diffusion of light from electric lamps, gas burners, &c." W. C. HOSKINS. Jaunary 30th.

1,757. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) January 30th.

1,765. "Cells of electric batteries." M. ROBIN. Janaury 30th.

1,766. "Means for supporting and attaching electric cables to insulators." R. A. SCOTT & R. WATT. January 30th.

1,773. "Variable-speed dynamo-electric machines." FULLER ACCUMULATOR CO. & A. P. WELCH. January 31st.

1,790. "Insulators for supporting electric conductors." H. R. LAMB. January 31st.

1,795. "Protecting devices of alternating-current apparatus." J. A. KUYSER. January 31st.

1,804/1,805 "Sparking plugs for ignition." A. E. HEATH. January 31st.

1,817. "Process for manufacture of copper compounds." HUTTENWERK NIEDERSCHONEWEIDE AKT. GES. VORM., J. F. GINSBERG & E. C. R. MARKS. January 31st.

1,833. "Telegraphic, &c., instruments and installations." J. HETTINGER AND C. A. VANDERVELL. January 31st.

1,834. "Sparking plugs." A. L. BILLON-DAGUERRE. January 31st. (France, November 14th, 1916.)

1,847. "Electric bracket for dashboard lighting on aeroplanes." H. C. S. SANDERS. February 1st.

1,852. "Galvanometers, &c." L. JOHNSON. February 1st.

1,865. "Device for stopping a motor, or giving warning when an obstruction occurs between its armature and magnets." J. ROBB & P. RUTHERFORD. February 1st.

1,878. "Process for manufacture and use of copper protoxide." HUTTENWERK NEIDERSCHONEWEIDE AKT. GES. VORM., J. F. GINSBERG & E. C. R. MARKS. February 1st.

1,879. "Electrolytic baths." HUTTENWERKE NIEDERSCHONEWEIDE AKT. GES. VORM., J. F. GINSBERG & E. C. R. MARKS. February 1st.

1,886. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) February 1st.

1,894. "Connections or connectors for electric conductors." K.W. IGNITION CO. February 1st. (U.S.A., July 12th, 1917.)

1,895. "Circuit breakers for ignition systems." K.W. IGNITION CO. February 1st. (U.S.A., July 23rd, 1917.)

1,896. "Electric furnaces." INDUSTRIAL ELECTRIC FURNACE CO. & A. E. WHITE. February 1st.

1,897. "Engine-starting devices." DAYTON ENGINEERING LABORATORIES CO. AND A. F. WHITE. February 1st.

1,903. "Electrical magnetic drive and clutch." D. C. HENRY. February 1st.

1,907. "Secondary or storage cells for batteries." COMMERCIAL TRUCK CO. & J. Y. JOHNSON. February 1st.

1,915. "Watertight plug-and-socket fittings for electrical connections." SIMPLEX CONDUITS, LTD., & L. M. WATERHOUSE. February 2nd.

1,918. "Self-starters for internal-combustion engines." ELECTRIC AND ORDNANCE ACCESSORIES CO. AND F. WOOD. February 2nd.

1,919. "Magneto-electric machines for use with internal-combustion motors, &c." J. H. RUNBAKEN. February 2nd.

1,937. "Armatures and coils for magnetos, &c." W. H. NIX. February 2nd.

1,942. "Wireless valves." C. J. BLUE. February 2nd.

1,948. "Sparking plugs for internal-combustion engines." F. A. L. JOHNSON. February 2nd.

1,962. "Electric glow-lamp sockets." C. O. BASTIAN. February 2nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

14,417. ELECTRIC MOTORS. Submersible & J-L. Motors, Ltd., and C. W. Durnford. October 10th, 1916. (112,475.)

14,439. ELECTRODES FOR STORAGE BATTERIES. R. Saville. October 11th, 1916. (112,476.)

17,476. METHOD FOR MULTIPLYING THE FREQUENCY OF ELECTRIC CURRENTS. Marconi's Wireless Telegraph Co. & I. Shoenberg. December 5th, 1916. (112,481.)

1917.

282. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. Lancashire Dynamo and Motor Co. & W. Stansfield. January 6th, 1917. (112,495.)

306. ELECTRICAL SIGNALLING SYSTEMS. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. January 6th, 1917. (Cognate application, 8,416/17.) (112,497.)

560. ELECTRIC LAMPHOLDERS. W. Engelke. January 11th, 1917. (112,507.)

935. ELECTRO-DEPOSITION OF COPPER. S. O. Cowper-Coles. January 18th, 1917. (112,516.)

1,256. SPARKING PLUGS. V. Perrett. January 25th, 1917. (Cognate application, 4,652/17.) (112,520.)

1,412. ELECTRICAL GOVERNORS OR SPEED REGULATORS FOR ELECTRIC MOTORS AND THE LIKE DYNAMO-ELECTRIC MACHINES. S. J. Anderson. January 29th, 1917. (112,525.)

1,517. TELEPHONE SYSTEMS. H. Symes. October 10th, 1916. (110,339.

1,576. FLYWHEEL MAGNETO DEVICES FOR INTERNAL-COMBUSTION ENGINES. Villiers Engineering Co., G. Funck & F. H. Farrer. January 31st, 1917. (112,529.)

1,629. IGNITION MAGNETOS FOR INTERNAL-COMBUSTION ENGINES. E. A. Watson & M-L. Magneto Syndicate. February 1st, 1917. (112,532.)

3,360. TELEGRAPHIC RELAYS. J. A. Fleming. March 7th, 1917. (112,544.)

3,437. SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 8th, 1917. (112,545.)

3,914. MAGNETO-ELECTRIC IGNITION MACHINES. O. Imray (Bosch Magneto Co.). March 17th, 1917. (112,547.)

4,418. ELECTRIC ARC LAMPS FOR PROJECTION PURPOSES. A. H. Railing, M. Solomon & A. E. Angold. March 27th, 1917. (112,552.)

4,790. ELECTRIC IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. R. F. Spiller, A. M. Paton & C. Hurst, Ltd. April 3rd, 1917. (112,556.)

8,470. ELECTRIC SWITCHBOARDS. G. Pailin & Ferguson, Pailin & Co. June 13th, 1917. (112,580.)

8,792. IGNITION DEVICE FOR EXPLOSION MOTORS. M. A. Violet. June 23rd, 1916. (107,388.)

14,446. ELECTRIC MOTORS. Submersible & J-L. Motors, Ltd., and C. W. Durnford. October 10th, 1916. (Divided application on 14,417/16.) (112,602.)

15,488. RADIO-TELEGRAPHY OR RADIO-TELEPHONY. Soc. Francaise Radio-Electrique. October 24th, 1916. (111,472.)

18,069. ELECTRIC SIGNALLING SYSTEMS. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. January 6th, 1917. (Divided application on 306/17.) (112,610.)

Research for the Navy.—Dr. Macnamara recently stated that reports of progress and recommendations were received by the Board of Admiralty from time to time from the Central Committee of the Board of Invention and Research. Mr. C. H. Merz, the well-known consulting electrical engineer, who had, as already announced, been appointed Director of Experiments and Research (unpaid) at the Admiralty, to supervise all the executive arrangements in connection with the organisation of scientific research and experiments for the Navy, had been added to the Central Committee. The appointment had been made as part of a considered scheme by which the scientific experts assisting the Admiralty would work in much closer co-operation than hitherto with the officers of the technical departments concerned. None of the distinguished scientists who were assisting the Admiralty as members of the Committee were accepting any salary for their services. The Admiralty desired to continue to have the benefit of the valuable advice and assistance of the Committee, and the revised organisation and appointment of Mr. Merz had received the unqualified approval of the Central Committee.—*The Times.*

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INDUSTRIAL COMBINATION.

WE cannot say that we cordially approve of the manner in which the Government is divulging the contents of the reports of the Committees that sat to investigate the position of the electrical, engineering, iron and steel, and other trades. As our readers are aware, the decision to give publicity to these reports in their complete form has not yet been arrived at, but they are appearing in "bits" in the Board of Trade *Journal*. We can quite understand that it may be regarded as necessary in the interests of National or Allied policy to hold up certain recommendations until a more suitable occasion, but the piecemeal method that is being followed at present is far from being satisfactory. We do not say that it is uninteresting to see where there is agreement between the different committees respecting such matters as standardisation and combination, for, of course, by means of these comparative statements we may be enabled to decide where a general policy common to them all or to several of them might be applicable. But the present practice will leave us always in doubt as to whether we have had all that ought to be vouchsafed to us. So far as the electrical and engineering trades reports are concerned, we hope it will be possible to publish these as separate documents, even if it has to be indicated that certain matters are withheld for a time in the public interest.

A week ago we referred in our "Notes" to the first edition of extracts which showed the need for combination amongst our manufacturers in order to secure the extension of standardisation, and to the necessity for their adjusting themselves to meet the requirements of foreign markets where accessories of types that they do not make hold sway. On another page to-day we quote from the Board of Trade *Journal* some further extracts which we deem of great importance to our readers. The argument in favour of combination and co-operation between British electrical companies and firms for the promotion of export trade is very familiar to readers of the ELECTRICAL REVIEW, and the various steps that have been taken during the past few years in such a direction by a number of battery, motor, and switchgear firms have been recorded here. It is many years ago now since we first placed before the trade the pressing need that existed in certain markets for combined action to enable the British electrical trade to stand up against the strong competitive efforts of Teutonic organisations. Such combination or co-operation was urged not merely in respect of selling organisation, but also in respect of manufacturing. A few years ago it was common knowledge that our isolated manufacturing efforts in certain lines led to suicidal competition which was quite as harmful as the unhindered competition of foreign traders. Happily, the development of the spirit of co-operation and a better organisation within the industry at home led to considerable improvement in this respect. But if we accept the conclusions of the Electrical Trades Committee we have still a long way to go, both in co-operative manufacturing and in co-operative selling, before we can consider that we are established in effective strength to resist after-war onslaughts which present enemies are preparing to make upon whatever markets will admit them. As the Committee state in the section of their report now published, the serious competition which British exporters have to face is almost entirely with the two or three big German organisations which for years past have consistently followed the amalgamation and association policy so as to resist ourselves and all other comers. The immense resources of these concerns, their highly-trained staffs, their branches established all over the world, and their elaborate research organisations made possible by the large extent of their operations, were understood here before the war, and their enormous financial strength through their close working arrangements with the leading financial institutions on the Continent was recognised as a factor which it was almost impossible for us to meet successfully under the unaccommodating and inelastic financial system that existed here. It will be observed that the Committee makes a comparison of the Teutonic policy of combination with our own disposition to discourage combination, greatly to the disadvantage of the traders of this country. A few weeks ago, when representatives of the Government trade departments were delivering speeches in some of the industrial centres urging certain trades to combine or be prepared to go under, we supported that advocacy. The report of the Electrical Trades Committee abundantly supports the combination speeches. Amalgamation or association for common purposes is regarded as the basis on which a sound and permanent industry can be established, and only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations. It is obvious from a good deal that is being said that the Government recognises such combinations as essential. Some evidence to this effect appears in the terms of reference with which the Minister of Reconstruction has appointed his latest Committee:—"In view of the probable extension of development of trade organisations and combinations, to consider and report what action, if any, may be necessary to safeguard the public interest." The combinations that we advocate have to do with the engineering and electrical trades, not with food, and such like. The new Committee will consider the effects of the application of the principle to all trades. Labour is represented on the Committee, and we have no doubt that from the inquiry it will learn a great deal of very useful information respecting the difficulties of industrial management and international trade.

Industrial Reconstruction.

The first public meeting of the Industrial Reconstruction Council, which took place on Friday last in the Guildhall Council Chamber, was a memorable war-time event. The piece of business that the Council has formed itself to undertake is obviously regarded as important by the powers in authority, or Lord Burnham, Dr. Addison (Minister of Reconstruction), Mr. G. H. Roberts (Minister of Labour), and Mr. J. H. Whitley, M.P. (Chairman of the Whitley Report Committee), would not have been there. After all that we have already published regarding the objects of the Council, and reflecting the views of Dr. Addison and Mr. Roberts concerning the need for making preparations which shall encourage more harmonious relations between employer and employed in the post-war period, we need not refer to the speeches at length, but there are one or two incidents or features which required comment. After we had recovered from the cold douche of the Lord Mayor, who reminded us that we were still at war—as though we were likely to forget it in these critical months—Dr. Addison said that the carrying out of all our preparations for the future depended fundamentally upon our being able to pay for them, and the governing consideration was, therefore, the increased production of wealth. Employers and employed must co-operate in increasing production or "distress must be our lot." "Unless we have Industrial Peace none of these things can be added unto us." We must so arrange our affairs that one man or one shop must not be able to throw a whole industry into confusion. Whitley Councils should go a good way toward avoiding trouble. No organisation of employers or workmen, said Dr. Addison, can help industry by promoting civil war, or by the manipulation of prices so that they keep their customers poor. "They cannot help industry by bolstering up inefficiency in any form. They cannot help a man who will not help himself. They ought not to try to regulate the pace by the pace of the slowest. They ought not to encourage inefficiency in any way. They ought not to fetter any man's freedom to make the best use of his own skill and brains." Familiar truths—wholesome truths—these, but very necessary for both sides to remember as we set out upon our new industrial era. The Council receives the Governmental blessing largely because it designs to help industries to help themselves.

Mr. Roberts's speech was delivered in his usual effective style, and contained some of that sound sense which is so essential to the encouragement of reason when industrial revolution appeals to the passions of violent sections. He was careful to remark in this connection that sure progress only flows from slow modifications of an existing order, and he was deliberate in his expression of feelings of strong opposition to those who "would lead my class into the portals of forlorn hope." The gathering was entertained later by a thorough-going representative of Labour who, with a sincerity as impressive as his speech was vigorous, let it be known that if the Whitley Report was seriously intended to remove from his class the hardships from which they had suffered in the past, if the employers were sincere in their desires for true co-operation, if they were prepared to give the workers a fair share in the fruits of their labour, if they were going to prevent Labour being thrown on the scrap-heap when slump periods followed periods of plethoric production, the Whitley proposals were acceptable as a step in the right direction. But if those proposals were a means for perpetuating the old conditions under the label of industrial peace, he was a revolutionary of revolutionaries. The Industrial Reconstruction Council has been planned with the view to securing the co-operation of all parts of industry, and it was not inappropriate that this voice should be heard and this point of view be expressed, but our impression was that there was little enough of a spirit of conciliation to be found in it. To pooh-pooh Mr. Bevin's charges and claims on behalf of his class would be unwise, but it must not be imagined that all Labour runs along the revolutionary course any more than it can be supposed that all the workers will be persuaded to accept the moderate or reasonably evolutionary ideas of Mr. Roberts. Both speakers were applauded by the Guildhall audience, and probably between the two the ultimate course of industrial harmony will be found to lie. A point in the speech of Mr. Whitley which we think took the meeting by surprise, was the fact that he, as chairman of the committee, had received more inquiries respecting the report from men with the Forces, and from correspondents in other parts of the world, than from inquirers in this country. We suppose the explanation is to be found in our nearness to and occupation with actual hostilities or with war production. But, as we mentioned last week, practical interest in the Whitley report is now more general in industrial centres here than it was, and it is to be hoped that the propagandist efforts of the new Council will be the means of stimulating further interest in its proposals as a practical measure for providing against the times when angry passions may be far too easily stirred up, and for securing increased production of wealth without unfairness or friction.

NATIONAL ELECTRICITY SUPPLY.

By a Power Station Engineer.

The Interim Report issued by the Coal Conservation Sub-Committee to the Minister of Reconstruction is one of the most important which those engaged on the supply side of the electrical industry have had to consider in recent years. Nor can it fail to be of interest to all manufacturers throughout the country, as they are deeply concerned in the adoption of the most economical, cheap, and reliable system of power in order that they may be assisted to maintain the supremacy which this country has established in the production of manufactured articles for the markets of the world. During the last few years this supremacy has been challenged by more than one other country, and had not the war intervened it is possible that the business which this country has done so much to build up in the past would have gradually been transferred to competitors who, by the adoption of more modern methods of manufacture and salesmanship, have been slowly but surely encroaching upon what has often been considered our own special preserves.

In view of the criticism levelled against the composition of the Committee appointed by the Board of Trade to consider the future of electricity supply, it will be of little advantage to comment at any length on the personnel of the Coal Conservation Sub-Committee. Several members are undoubtedly well qualified to offer advice on the subject matter of the report. The case for coal conservation by means of increased adoption of electrical motor power is so strong in itself that no useful purpose appears to have been served in the report by deliberately going out of the way to belittle the work which local authorities have carried out in the past in connection with the development of electricity supply. Few will question the fact that many men, who have been at one time or another employed on the spadework of municipal development, would have been willing and able to assist in the consideration of this important problem, and whose presence on the Committee would have tended to restrict within reasonable limits the objectionable comments introduced, without in any way detracting from the principles which the report seeks to establish. The spirit underlying the whole report is one of undoubted hostility to the work at present carried on by local authorities. No public service has apparently been rendered by them in the past, nor should there be any place for them in the future. Only one, or possibly two, electricity supply concerns receive the Sub-Committee's blessing, *i.e.*, the group of companies on the North-East Coast and the power station of the Underground Railways at Lots Road. All the large municipal undertakings in the Kingdom with the exception of Glasgow, which by curious chance or intention is not mentioned, are condemned for one reason or another.

I have no intention of offering any criticism in regard to many of the matters dealt with; there is much that must receive the unstinted support of those who are in the best position to give an opinion as to the ways and means to be adopted in the future if electricity supply is to become what by rights it must and ought to be become, *i.e.*, "*The* key industry of the country," but that is no reason why one should not examine and comment upon some of the data on which the Committee apparently founds its conclusions. The report is undoubtedly strong in the main features of its findings, but the facts and figures on which many of the arguments are based are lamentably weak, or absolutely inaccurate, and I propose as shortly as I can to deal with some of these points.

The report is intended to deal with coal conservation only, and therefore proceeds to review the production of fuel by the collieries, and the subsequent disposal of it. Of a total get of 280 million tons in 1913, it is assumed that some 80 million tons represent the quantity used for the production of power, including railways, and this is the amount which may be affected by any general improvement in methods of consumption. After a somewhat lengthy discussion on the result to the country if industries would increase their production threefold, which is probably a matter more nearly concerning chambers of commerce than coal conservation, the report goes on to point out that this desirable end may easily be obtained if only the consumption of fuel per h.p.-hour is reduced by one-third. Reference is also made to the fact that during the last 25 years the coal consumption per h.p.-hour has been halved. The argument is developed to show that if all the power requirements were supplied electrically, and the present average consumption of 5 lb. fuel per h.p.-hour reduced to the equivalent consumption in the N.E. Coast power stations of 1.54 lb. per h.p.-hour, the total coal used at present for power purposes would be reduced by 56 million tons per annum. In order to obtain such a result, practically all existing power stations would be scrapped, and new super-stations, having from 100,000 to 250,000 kw. total capacity, and possessing generating sets of 30,000 to 50,000 kw. size, would be provided instead. It may be of interest to observe that although the North-East Coast is several times mentioned as being the one example of all that is right and proper in power-station practice, and the district supplied is undoubtedly one suitable for the development of electricity supply, those responsible for the design of the power stations have not yet found it advisable to install any individual generating sets of so large a size as 20,000 kw., not to mention 50,000 kw., although we are told that substantially all the power users of importance are already taking a supply from the companies. The question naturally arises why one of the members of the Committee who is largely responsible for the companies' operations has not adopted such large units of plant in one of the most concentrated industrial districts in the country, and yet advocates their use under less favourable conditions elsewhere. The claim in regard to supplying practically all of the industries in the North-East Coast is one which may well be challenged. Information is available which makes it more than doubtful whether this desirable end is yet obtained. Statistics would probably show that possibly only one-half, or even one-third, of the industries are being supplied from the public source, and if the district has already reached the saturation point electrically, there is a less brilliant future before the group of companies than appears to be contemplated by those associated with them.

It is generally recognised that one important point on which the successful development of an electrical supply undertaking may be judged is the units supplied per inhabitant of the area in which the supply is given. It offers a fair indication of "the initiative and resource of supply undertakings" on which so much stress is made in the report. Considered from this point of view, and taking the output of the North-East Coast companies as approximately 400 million units per annum, and the population on the basis of the 1911 census as 2,300,000, the units sold per head amount to about 174 per annum, and this *includes* a supply to railways, a class of supply which has been given by only one or two other supply undertakings in the country. There are already a number of local authorities in the Midlands supplying over 200 units per head of the population. In this connection also it is of interest to note from the published reports of the Lancashire and Cheshire Interconnection Committee that 26 undertakings, having a population of 2,376,000, supplied about 370 million units during 1915-16, giving an average of 156 units per head of the population, *excluding* any supply for railway purposes. With this information available to guide them, it is difficult to understand why those responsible for drafting the report should state that the N.E. Coast companies supply three times as many units per head of the population as the Lancashire municipal undertakings, when such a statement is quite contrary to the facts.

(To be concluded.)

TELEPHONE EXCHANGE TRANSFERS AND THEIR ORGANISATION.

By F. G. C. BALDWIN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

A transfer of subscribers' lines from an exchange in operation to another exchange usually coincides with a change in the system of working, and the replacement of old plant by more modern equipment; in this country the change most frequently met with is from magneto to central-battery working, with lamp signalling, and the methods of transfer are to some extent standardised. Transfers may be effected in three ways:—

(*a*) By transferring each line independently.
(*b*) By transferring the subscribers in groups.
(*c*) By transferring the whole of the lines at one operation.

Method (*c*) is the one usually adopted. The operation can be carried out expeditiously—the time taken being measured in seconds—and a period can be selected for the change when the least possible interruption to the service will ensue.

The subscribers' lines to be diverted must be dealt with in such a way as to render each line available for simultaneous connection to the new exchange when the circuit is severed from the old.

It will be necessary to install new cable plant from the new exchange to one or more suitable points where the lines affected may conveniently be tapped. These points may be situated as follows:—

(*a*) On the existing main underground routes.
(*b*) On the existing overhead lines.
(*c*) At the old exchange.

Existing conditions will to a large extent govern the line-plant arrangements to be adopted. In one of the simplest arrangements, new cable plant is provided between the new exchange and a point conveniently located on the existing cable system at which the whole of the lines are available. At this point Teed connections are made, thus linking the circuits to the main distributing frame of the new exchange.

Generally speaking, the tapping of the existing lines at the old exchange is undesirable, in consequence of the difficulty in avoiding interruptions of the working lines when cutting them out of the old premises after the transfer.

If the distance between the old and new exchanges is not excessive, it may be an economical proposition to divert the whole of the subscribers' lines into the new exchange, and thence to extend them temporarily to the old exchange. In this case the point at which the lines are Teed will be situated at the main distributing frame of the new exchange. This arrangement greatly simplifies the operations to be performed both at the transfer and afterwards; but the cost of provision of the circuits between the old and new exchanges, for the purpose of accommodating the subscribers' services until they are transferred, increases with the distance between the two exchanges, and unfortunately precludes the adoption of this method in every case.

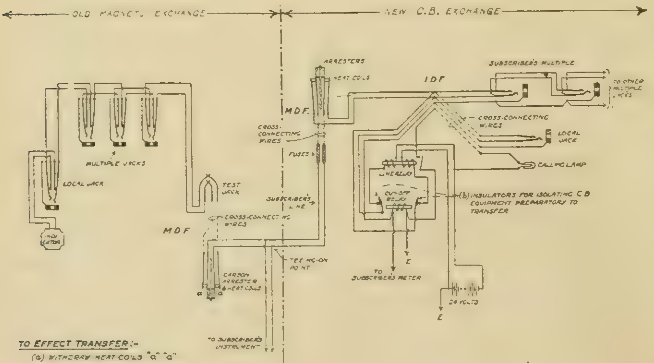

Fig. 1.—Circuit Arrangements for Transfer of Subscriber's Line from Magneto to Central-battery Exchange.

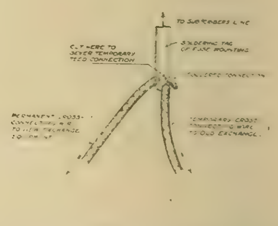
TO SUBSCRIBERS LINE
SOLDERING TAG OF FUSE MOUNTING
CUT HERE TO SEVER TEMPORARY TEED CONNECTION
SOLDERED CONNECTION
PERMANENT CROSS-CONNECTING WIRE TO NEW EXCHANGE
TEMPORARY CROSS CONNECTING WIRE TO OLD EXCHANGE.

Fig. 2.—Method of Making Temporary Tee Connections on Main Distributing Frame when all lines are diverted through New Exchange Prior to Transfer.

This arrangement is a highly satisfactory one, and possesses the following important advantages:—

1. Elimination of external teeing points and consequent immunity of faults from that source.
2. Alterations to working circuits after transfer reduced to a minimum.
3. Severance of the old from the new plant automatically at transfer, and possibility of trouble arising from old plant left in circuit removed.
4. All Tees assembled at one perfectly safe point, affording facilities for their prompt removal.
5. Transfer operation conducted wholly in the apparatus room of new exchange.
6. Cost avoided of possible renewals to old plant to be afterwards discarded.

When the distance between the old and new exchanges is considerable and the circuit capacity of the line plant is necessarily limited, it may be advisable to have recourse to the method of transfer in groups. Several disadvantages are inseparable from this method.

Circumstances do not always permit of one arrangement only being employed, and in some cases two or more different arrangements are necessarily embodied in one scheme.

Fig. 1 shows that portion affected of the electrical circuit of one subscriber's line only, prepared for transfer from a magneto to a central-battery exchange.

The problem is to disconnect all the working lines from the old exchange and, simultaneously, to connect them for immediate service to the new exchange. Upon reference to the diagram it will be seen that if the heat coils at the old exchange are withdrawn, the exchange line will be disconnected there, and that if the insulating separators shown between the spring contacts of the cut-off relay situated at the new exchange be thereafter removed, the circuit will be at once thrown on to the new equipment, leaving the portion of the line between the Teeing point and the old exchange as a Tee upon the new circuit.

It is essential that the withdrawal of the separators from the cut-off relays should not be attempted until all the heat coils at the old exchange have been removed; failure in this respect will result in the circuit being closed through the indicator winding at the old exchange, and the calling lamp at the new switchboard actuated.

The means adopted for the extraction of the heat coils must be such that the whole are removed within the space of a few seconds. This can best be effected by means of two fairly strong tapes threaded behind the coils from top to bottom, one on each side of the strip, the two ends at top and bottom being bound together. If the bound extremities of the tape be held, one in each hand, a fairly smart and extended pull will cause all the heat coils in the strip to spring out of their clips. The possibility of faults being caused by displacement of springs or carbon blocks of arresters during withdrawal of the heat coils should be guarded against. If the protectors are of the earthing type, precautions are necessary to prevent the springs making earth when the heat coils are withdrawn. To avoid possibility of earth faults appearing during the period intervening between the transfer operation and the removal of the Tees, the whole of the carbon blocks and mica separators may be withdrawn, dusted, and replaced before the tapes are fixed.

To withdraw the fibre separators, a length of tape is passed successively through holes punched in the 10 separators of each relay mounting, and loops are provided at each end. The 10 separators may be withdrawn simultaneously by smartly drawing forward the tape whilst the loops at its extremities are held one in each hand.

Where the protectors are provided with additional springs in order to admit of the insertion of the test plug without first removing the heat coils, wooden insulating plugs may be inserted between the springs, so insulating the Teed lines from the new exchange plant. The withdrawal of these plugs will serve the same purpose as the withdrawal of the separators from the cut-off relays. A cord threaded through holes bored in the insulating plugs provides means for their simultaneous extraction. This method has the advantage that it avoids disturbance of the cut-off relays; also during the time the preparatory work is in hand, the heat coils may be kept in position from the outset, the new equipment being completely isolated by the wood wedges from the portion of the circuit external to the new exchange. If it be required to test any line with the new exchange equipment, the insulating plugs associated with the respective line may be removed (sufficient slack being left in the cord to admit of this being done) without removing the heat coils.

To provide testing and other facilities two break jacks are permanently included in the circuit of each junction line at the exchange. The jacks associated with the whole of these circuits entering an exchange are usually mounted together in a convenient position on the main distributing frame. From a convenient point on the line, a Tee is conveyed into the new exchange, where the line is insulated by the insertion of an insulating plug in one of the break jacks. The insertion of a similar plug into the jack at the existing exchange (or alternatively the withdrawal of the heat coils) and the withdrawal of the plug at the new exchange will have the effect of disconnecting the line from its existing exchange and throwing it on to the new.

The central-battery system demands that the line plant should be maintained with a relatively higher standard of insulation. Fleeting troubles, such as intermittent earths, contacts, and short-circuits of but little moment in the case of the magneto system must be eliminated. Therefore, when the change is from magneto to central battery it is advisable that the open line plant be overhauled, and such weaknesses removed.

In view of the peculiar troubles to which open lines associated with a central-battery system are likely to give rise, it is desirable that, so far as economically possible, the proportion of open line plant should be limited. Where the establishment of a central-battery system is justified, it is generally economical to arrange an underground system with distributing points from which the subscribers' services are completed by means of small distributing cables underground or short sections of open wire. In this way the mileage of open line is minimised.

The provision of Tee connections in association with the transfer of a large exchange is a matter of considerable importance. The manner in which the connections are first made and afterwards maintained has considerable influence upon the success with which a transfer is accomplished. An unsystematic arrangement of indifferently made Tees will undoubtedly be an endless source of trouble and anxiety to the engineer controlling the operations.

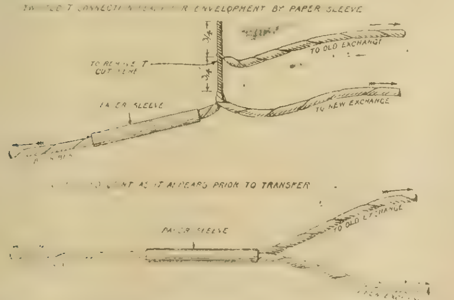

Fig. 3.—Method of making Tee Connections on Paper-Insulated Conductors in Underground Cables.

The small gauge wires on large cables (600 and 800 pairs) commonly used in modern telephone systems demand exceptional care in this connection, and it is highly desirable that, when once the Teed connections have been made, they should not be subjected to more disturbance than is absolutely unavoidable.

Fig. 3 illustrates a suitable form of Tee connection. The method permits the removal of the Tee without disturbing the through connection, and facilitates identification of the wire to be cut away.

Cast-iron cable boxes have been utilised in an attempt to facilitate hermetical closure of the cable and to provide ready means of access to the Tee connections. If such a measure be adopted, it is still desirable that the wires should be waxed and bound in order that they may satisfactorily withstand any handling to which they may be subjected. The box introduces limitations in the available space, and access to the wires is even more difficult than in the case of an open joint. No advantage is gained by their use except perhaps where the number of wires to be dealt with is limited.

A suitable method of forming Tee connections on open-wire lines is illustrated in fig. 4.

When the line arrangements for transfer admit of the Tees being made within the new exchange the serious difficulties introduced by external Teeing points are entirely removed. In some cases the Tee connections can conveniently be made at the main distributing frame of the new exchange, and a suitable method of forming the individual Tees is shown in fig. 2. This method is economical, admits of temporary disconnection of the Tee piece for testing purposes without disturbance of the permanent portion of the new circuit, and the Tees can be cut away rapidly without disturbing the through connection, which is left in its permanent state, no further attention being required, and no evidence of the Tee remaining.

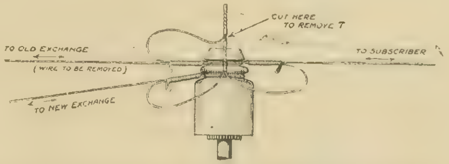

Fig. 4. Method of making Tee Connection at Point on Existing Open-wire Line.

The removal of a telephone exchange is often accompanied by a change from magneto to central battery, by which the introduction of automatic calling and clearing effects a quicker service. The displacement of the magneto generator and primary batteries at the subscriber's station renders a complete change of apparatus desirable, although not absolutely necessary.

Existing apparatus may be modified to permit of central-battery working until the modern central-battery apparatus is installed after the transfer. It will usually be economical and convenient to adopt this alternative in cases of subscribers' simple sets, and at stations with only one extension. In the case of installations with switchboards it is advisable to install new central-battery apparatus prior to the date of transfer, introducing the modifications necessary to provide for satisfactory working until the transfer has been made. The modifications required consist only of the provision of ringing facilities and of battery power for speaking purposes.

It is necessary to ensure that the receivers of all instruments are connected in such a way that the current received over the line from the central battery will augment rather than reduce the magnetism of the receiver magnet.

In ordinary cases the work to be carried out at the existing exchange prior to transfer will be mainly that of testing out the circuits in conjunction with instrument fitters, and making line changes with line foremen and jointers. Where a large number of subscribers' lines is concerned, the amount of testing to be done will be considerable, and it may be necessary to augment the existing testing equipment.

A suitable figure representing the minimum insulation permissible is 100,000 ohms for a central-battery exchange working at 40 volts.

Final tests of subscribers' lines are made at the test desk of the new exchange, and may occupy several days. Each circuit to be transferred is proved to ensure that the insulation and conductivity of the line are satisfactory, each subscriber is connected to the correct exchange equipment, the condenser is in circuit, and speaking is satisfactory. Each junction circuit to be transferred requires to be finally tested under actual working conditions between the new exchange and the distant exchange. The readings of subscribers' meters must be recorded immediately prior to the transfer.

After withdrawal of the fibre separators from the cut-off relays at the transfer, it is advisable to verify that the relay springs are making contact. A headgear receiver and a 2-microfarad condenser are connected in series, the free terminal of the condenser being connected to earth. A wire attached to the free terminal of the receiver is first tapped upon the lower spring of the cut-off relay, then against the upper. This should alternately charge and discharge the condenser, and a click should be heard in the receiver. The absence of a click denotes a fault.

On the evening of the day prior to that fixed for the transfer, rehearsal of the operation should be carried out under the direction of the officer responsible. Each man who is to take part should be interviewed at the position allotted to him by the officer controlling the transfer, in order to make certain that the duties are thoroughly understood.

The success of the operation will largely depend upon the thoroughness with which the whole of the preliminary work has been arranged and carried out.

During the period immediately prior to the transfer, the circuits already connected in working condition to the new exchange should be tested out and proved in order.

At the pre-arranged time, the first portion of the junction circuits to be transferred, viz., those which have been scheduled for treatment in advance of the subscribers' lines, and which may approximate to about half the total number of junction circuits to be dealt with, should be diverted. This is accomplished by first inserting insulating plugs in the junction test-jacks of the circuits concerned at the old exchange, and immediately afterwards withdrawing the plugs from the corresponding jacks at the new exchange. These circuits may then be tested out, and any faults cleared before proceeding with the remainder of the lines.

At the appointed time the subscribers' lines and the remainder of the junction lines should be dealt with as rapidly as possible in the following manner:—

(*a*) The test clerk at new exchange requests over special telephone line the removal of heat coils at old exchange, and waits for advice that this has been accomplished.

(*b*) On receipt of this intimation, the test clerk gives pre-arranged signal to:—

1. Extract separators from cut-off relays, and
2. Withdraw remainder of plugs in junction test-jacks.

(*c*) The exchange supervisor and the test clerk at old exchange are then advised that the transfer has been accomplished, and the officer deputed to carry out relay tests is directed to proceed.

(*d*) The test clerk at old exchange informs supervisor there that transfer is completed.

Traffic conditions must be taken into account in selecting a day and time for the transfer operation. For several reasons it is desirable that a time should be chosen when the volume of traffic to be handled will be at a minimum, and that the same condition should obtain for as long a period as possible immediately following the transfer operation. This will ease the operating staff, give them an opportunity for the requisite testing, minimise interruptions to the service, and permit of a large proportion of the junction circuits being transferred in advance of the subscribers' lines; also opportunity will be afforded to remedy any defects which may arise, and to carry out any work, such as the removal of Tee connections, which requires to be done before busy traffic conditions are resumed.

In order to secure uniformity of attention to calls, it is necessary to distribute subscribers' circuits over the answering positions of the switchboard not in numerical order, but in relation to their traffic activities. Such distribution must be based upon actual observation of conditions obtaining for each subscriber's line, undertaken many weeks before the transfer is due, so that a scheme for the grouping of the subscribers' circuits may be completed by the time the intermediate frame is in readiness for cross-connecting.

A programme of instruction for the guidance of the operating staff concerned in the transfer should be drawn up, in order that no essential detail be overlooked.

Operators who are to be transferred from the existing to the new exchange should be familiarised with the working and local conditions of the new board in advance of the transfer.

After the transfer has been accomplished, the cutting away of Tees should not be commenced until the exchange staff has finished the tests of the whole of the transferred lines. Assuming that the exchange as a whole is then working satisfactorily, instructions may be given to cut away all Tees terminating on the springs of the protectors at the old main frame. The early removal of all Tees is advocated, as a possible source of faults will thereby be removed. In cutting away Tees in underground cables, each wire of a pair should be cut separately to avoid the momentary glow of the calling lamp which would otherwise be occasioned. When all the Tees at one point have been removed, the final jointing operations may be proceeded with, and when completed the joints should be plumbed in the ordinary way.

The prompt severance of all Tees on open-wire lines should be immediately followed by removal of the discarded portion of the circuit and the final restoration of the open-line plant where necessary.

To secure the most economical and efficient results in connection with a transfer of material dimensions, careful organisation of the whole of the work involved is obviously necessary.

From the point of view of economy, it is particularly essential that the various sections of work should be co-ordinated in such a manner as will preclude delay being caused to any section of the work by non-completion of any other section within the requisite time.

In order to reduce to a minimum the liability of interruption to which the service will necessarily be subjected, it is preferable that the various works associated with a transfer should be organised in such a way that no work which can possibly be done before the actual transfer be left until afterwards. Reasons for the adoption of this precaution are as follows:—

(*a*) There is a greater possibility of disturbance in carrying out work on the central battery than with the magneto system.

(*b*) Workmen inexperienced in central-battery working, although accustomed to the magneto system, may not at first appreciate the greater care required.

(*c*) Operators transferred from a magneto to a central-battery switchboard do not at once obtain full proficiency, and should be caused as little trouble as possible from interference with working circuits.

An essential to successful transfer is the preparation of a complete programme embracing the whole of the work involved in the final preparations and in the actual transfer operation. This will guard against any essential operation or requirement being overlooked.

It is advisable that complete control of the transfer operation should be vested in one individual situated at one recognised point of vantage. The most suitable position will no doubt be at or in close proximity to the test clerk's desk.

Discussion in London.

Mr. **Stubbs**, in opening the discussion, said telephone men would be grateful for the author's valuable contribution to this important branch of the art. He was glad the author dismissed the idea of piecemeal transfers; even where two exchanges were to be transferred to one site it was still good practice that both should be transferred simultaneously. The transfer of the line plant by Teeing underground, &c., was also sound practice, where it could be done; the idea of Teeing lines at the old exchange was much more open to question, and did not appear to have any advantage over excluding the old exchange. The author did not appear to like the arrangement he referred to where plant was limited; but he (the speaker) thought it had considerable attractions, and it was well worth while to consider it. In the case of an ordinary subscriber, when transferring to an automatic exchange, it was impossible to leave the old instrument, and in this case they arranged for the bell condenser to be transferred while the old instrument was in use. The time programme showed how essential was care and experience in successful transfer work.

Mr. **Moir** said the paper brought out the great difference between the light and heavy sides of electrical engineering. The telephone engineer had not only to connect to his subscriber, but to carry his wires back to the exchange and connect through apparatus there, which accounted for the wealth of detail in the paper. A break could cause great trouble; as an instance of this, a fire in a subway which affected a few telephone cables necessitated the making of 19,000 new joints before the service was restored. As regarded the fibre separators, sometimes a small piece of fibre was left between the contacts, and he preferred a small wooden plug under the relay spring. It was necessary to use great care to secure favourable conditions for installing the equipment in a newly-built exchange. The Post Office authorities were not shy of transfers, as they had opened nine new exchanges in London with 62,000 subscribers between taking over the system and the war, and 19 cases for new exchanges were being investigated at the time war broke out.

Mr. E. S. **Bynd** said transfers of exchanges were due mostly to lack of capacity; it was interesting to note that engineers now worked on a planning period of 15 years when estimating the building requirements for new telephone exchanges in order to avoid too frequent transfers. Obsolescence often occurred due to the introduction of new operating methods; in some cases the ideal position for the exchange altered due to development of one part of the area, and it might be economical to secure a more central position. The termination of tenure, or a fire, might also necessitate a transfer. The difficulties and risks of having external Teeing points could not be over-emphasised with multicircuit cables. Where it was possible to divert lines *viâ* the new exchange it was preferable, as it avoided external Tees, which were always unsatisfactory. If capacity was limited it might be necessary to interconnect several large cables in a manhole, and a plumbing flaw if the manhole were flooded might break down the whole telephone service. The method of making Tees illustrated by the author was a great improvement on the old method, where the three wires were made in the same twist. A telephone transfer was the most difficult work which fell to the telephone engineer, and the paper would be of great value to engineers in the future.

Mr. **Bryant** mentioned that in the case of the National Telephone transfers from magneto to common-battery, hardwood wedges were ultimately adopted for separating the relay contacts after trying various methods.

Mr. E. A. **Laidlaw** agreed that trouble was experienced with fibre and paper separators—numerous tests had shown that about six weeks after opening trouble ensued, and more faults were experienced than with wood plugs. The author's method of transfer was a good one, but costly; at a large centre, such as Manchester, it had been found that by making suitable arrangements for transfer with subscribers at the week-end, straight-through joints could be made for practically all of them; of 300 subscribers, it had been found that in only eight cases was it necessary to maintain the connection on Saturday afternoon.

Mr. **Edmunds** said there would be a very large amount of transfer work to be done immediately normal times came, and the paper would be particularly valuable then. Even telephone engineers might question whether the cost incurred n carrying out the work set out in the paper was justified; he prime reason was to avoid interference with the public ervice, and it was worth a large capital expenditure to avoid lepreciating the value of the telephone service in the eyes f the public. When the new exchange could be connected n parallel with the old one, it was possible to clear up faults efore the transfer took place; experiences of this method at Victoria had been quite satisfactory. It was necessary for the traffic staff to closely co-operate with the engineering staff; the engineer must be sure that the service point of view was properly appreciated by his men. Faults in transfers could not be avoided, but the operation of the new exchange was often on a higher plane than that of the old one.

Mr. ANSON said it was generally agreed that the wedge was the best method of separating relay contacts; the paper was valuable as showing the organisation necessary in transfer work.

Mr. HEADLEY said the usual Post Office practice in connection with line plant was to use outside Tees and the grouped line method; he would like to know of instances where Teeing at the exchange was better. It was always an advantage to make use of existing plant, and this justified the grouped line scheme; two subscribers' lines were required, one to the old exchange and the other connecting the old and new exchanges; work had to be done in manholes outside, and it would be useful to have a diagram showing the method adopted. The grouped line scheme was the best one for large transfers, and it saved heavy expenditure in some cases.

The AUTHOR, in his reply, mentioned that his experience of the method of transfer with limited line plant was that the expense during the period of preparation was much in excess of the annual costs for some years of the additional cable plant required.

DISCUSSION AT NEWCASTLE.

AT a meeting of the NEWCASTLE LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS at Newcastle, on February 11th, Mr. F. G. C. BALDWIN submitted his paper upon the subject of telephone exchange transfers.

Mr. J. R. M. ELLIOTT, in opening the discussion, said the transfer of a telephone exchange was a subject that had received scant attention in literature; it was often an operation of the first magnitude, the cost in many instances running into many thousands. The conditions to be met in carrying out a transfer were varied and difficult. Mr. Baldwin had given just the information that was wanted. The development of the telephone service had been greatly retarded in consequence of the war, but once matters were in their normal state again, there would be a great programme of work, and a number of exchanges would be dealt with, for an attempt would be made to unify the systems of the National Co. and the Post Office, and that could only come about by the establishment of new exchanges, with common battery systems and automatic systems, instead of the magneto. As to Mr. Baldwin's three methods of carrying out a transfer, he thought that the most efficient and most economical system was that of transferring the whole of the subscribers at one operation; he had never heard of a transfer being made by an individual line at a time. The line rearrangement was a most important factor, but he thought no hard and fast rule should be laid down; it was a question of local conditions, and these varied too greatly to allow of a standard method being fixed. Where it could be done, he would strongly advise the adoption of the method proposed by Mr. Baldwin, to divert the whole of the subscribers' lines into the new exchange, and then temporarily to extend them to the old exchange. This, he thought, even if carried out at a slightly increased cost, would be more efficient than the other methods under consideration. He thought Mr. Baldwin's method of withdrawing the heat-coils was a barbarous one, and that they would be liable to get damaged. A better way would be to encircle each coil with a clip, and thread a tape through the clips, so that when the tapes were drawn the coils would come away. That raised the question whether momentary changes over were necessary. He did not think they were. If a definite time were given for each operation, so that the whole transfer could be spread over, say, five minutes—it might cause a little inconvenience to subscribers—he thought the freedom in operation would justify the delay. They had found a good time to make the change was two o'clock on a Saturday afternoon, for it gave a good amount of time before Monday morning. Passing to a consideration of the reference in the paper to insulation, the speaker said that the recommendation made by Mr. Baldwin of 100,000 ohms was not clear to him. He did not favour the fixing of a minimum; the insulation depended upon the weather, and he thought a great deal must be left to the testing officer himself. He raised the question as to the number of faults that would arise, were the exchange made ever so carefully. He thought these should not be more than 2 per cent.

Mr. KITCHEN said the question of storage had not been mentioned by Mr. Baldwin, and he thought in commencing the work of exchange some sort of storage should be arranged for; if that were done and there was a good storekeeper, the work would be greatly facilitated. From the time of estimating for an exchange to the actual time of removal, canvassing for subscribers should be discontinued. With regard to the testing of heat-coils, he suggested that the difficulty of getting back heat-coils, could be overcome by making a limit gauge. He differed from Mr. Elliott as to the insulation of the line. He thought it was very necessary that they should have a standard.

Mr. PEEL, Mr. BAILEY, and Mr. A. C. HOVER also took part in the discussion, the last remarking that subscribers disliked their numbers changed in what appeared to be a very autocratic manner; their number was to some traders almost like a trade mark.

Mr. BALDWIN, in the course of his reply to the points raised, said he had known a newly-opened exchange have fewer faults than the old one; by careful organisation they had managed to get the faults reduced to .2 to .5 per cent. As to what had been said as to the methods of transfer, a combination of all the methods he had named might be made, and there were also other methods. To attempt to make a standard method would be, he agreed, a mistake, they were governed so largely by local circumstances. The method of the lowest cost, all else being equal, was usually the method adopted. As to the suggestion that he treated the heat-coils in a barbarous manner, and Mr. Elliott's suggestion that clips should be used, they must consider that heat-coils were themselves inexpensive things, and whatever method they might adopt must not cost more than the heat-coils that were damaged or broken. He was no advocate of a momentary change-over. With regard to what had been said as to insulation, he thought there should be a minimum. If a circuit would work on a set insulation there was no reason why money should be spent on increasing the insulation beyond that figure.

ORGANISED EFFORT.

By A. L. STANTON, A.M.I.E.E.

(*Abstract of an address delivered before the* SWANSEA AND DISTRICT INSTITUTE OF ENGINEERS.)

A LITTLE thought upon the conditions immediately preceding the war will very clearly indicate that "limitations" were, more or less, the order of the day. The history of industrial disputes, the failure to realise the advantages to be derived from the adoption of co-operative principles as against wasteful competition in industrial enterprise, and a disinclination to overcome the obstacles tending to hold up the expenditure of wealth on the development of industries along the most modern lines—all provide striking evidence of "limitations" which form a serious drag upon the wheel of progress. The conceptions of life immediately ahead can never again be as they were. We are passing through an era of destruction, but after its destructive power has exhausted itself, the ever-present constructive force at work again demonstrates its absolute supremacy in the realm of reality, and movement after movement for the attainment of a greater freedom from limitation follows.

The State should recognise the advantages to be gained from equipping its citizens, so that all may successfully engage in that primary function of physical life—the earning of a living, free from the nightmare of poverty. "Patriotism" used to be more or less associated with Empire Days, national history days, and Navy League annuals, but the militant spirit is only one aspect of the *full* spirit of true patriotism, which makes a demand upon the everyday life of the individual, during both days of prosperity and those of stress and trial.

Too often do we all set limits to ourselves. As one result of it, the average trade unionist is not so interested in the value of the work he performs from a national point of view as he is in the securing of personal advantages from the doing of it. A similar spirit also too often animates the employer. If it were otherwise, then discord and distrust between Labour and Capital could not exist. Moreover, a belief in the power of *destructive* criticism prevails, which is, in itself, productive of much discord. A real need exists for *constructive* criticism, and this can only be developed through cultivating the power for right and independent thought among all concerned. A primary duty to-day, therefore, is to give heed to the necessity for developing the constructive sense in its full power.

This war constitutes, more than any other, a truer vision of organised effort between nations. Organised effort has become the predominant thought, for war under present-day conditions has become a national industry. All errors due to proved inefficiency are invariably associated with waste of some kind. Germany recognised the value of this principle long ago, with the result that when the call came, every individual had a pre-arranged definite part in the organised effort which the conditions were deemed to demand; all had their relative positions delineated on the scheme of operations, so as to provide for a minimum of national waste. Its results are self-evident in the prolonged resistance they have been able to put up, against the vast resources arrayed against them, and in the rapidity with which they have changed their tactics, or methods, when any principle in operation proved defective.

It is only by making an analysis of the causes which enabled Germany in a few decades to rise from comparative obscurity to a dominant position in the industrial life of the world, that one is enabled to gain some idea of what "organised effort" means. Every student of economic history knows that in Germany it commenced with the child, and continued throughout the life of the individual. Collective efficiency was the watchword; individuality, as we know it, was never fostered. Moreover, just as every boy in China used to be taught geography from the point of view that China was the centre of the commercial world, so was the young German led to think that the main elements of modern science originated with his people. We ourselves have very largely fostered the belief in the superiority of other industrial nations by the publication of sensational articles belittling our own methods, and have put a premium upon efficiency by stifling originality and initiative. If the maintenance of our industrial life is to be held secure, "incentive to achievement" free of limitation for the really efficient worker must be recognised as a fundamental demand of the new conditions which the conclusion of the war will bring about.

Is not a heavy penalty being exacted for its past non-recognition even now? Obviously the German system had grave defects, but withal, it did produce huge numbers of highly-trained men in the technical and industrial sense who willingly worked for comparatively low wages, by reason of the incentive given through research work and industrial prizes of high value. They were thus able to make and sell many commodities at a lower price than their competitors, and if to the features outlined are added a more positive control of labour than was possible elsewhere, with the co-operation of the Government, and that in an autocratic sense, for the pushing of exportation and transportation, no surprise can be expressed upon learning that such a system produced results. Efficiency undoubtedly begets confidence, and that particular quality associated with the German system developed it in bulk.

The prime attraction of the German-made article was its cheapness, coupled with the fact that the German manufacturer never forced standardised articles upon his customers. On the contrary, he was always willing to make any article according to the demand, and moreover, gave free advice on it. These are all points which count, and it is self-evident that business organisation acting in an "organised effort" with technical skill, can effect progressive enterprise to an extent not possible otherwise.

All industrial activity depends for its operation upon a continuous supply of energy, and few will contradict the assertion that electricity is the most convenient and flexible form whereby energy can be transmitted, distributed, and utilised; but at the present time its generation and distribution is conducted upon anything but efficient lines. A proper recognition of this has only been brought about by the war limiting the output of fuel. The value of "organised effort" in this field of utilitarian activity will be self-evident if the enormous saving and extension of service rightly to be anticipated as a result of putting into operation well-designed schemes of linking-up areas are realised. The question of main-line railway electrification is another field which the near future should bring right to the forefront. Anyone interested in either electrical or railway development will be acquainted with the serious limitations imposed by legislation of an obstructive nature. Is it too much to hope that one can look forward to the time when some legislative control of a constructive nature will be exercised over matters relating to the standardisation, development, and purchasing power of natural resources? It may not be amiss to point out yet another aspect of national waste, wherein "organised effort" can assist utilitarian ends. It is well known that the British iron and steelmaster has in the past shown reluctance to give the by-product recovery coke-oven a chance to demonstrate both its saving power and its earning capabilities when compared with the bee-hive oven. Fully three-fourths of the coke produced here is made by the bee-hive oven process, which undoubtedly is one of the most wasteful industrial processes in operation. The only saleable product of the bee-hive oven is coke, whereas the by-product recovery plant type produces, in addition to coke, power gas, benzol, tar, and sulphate of ammonia. Furthermore, as the acid required for the conversion of the ammonia by-product into nitrate now admits of being made by electric power, on sound commercial lines, at the point where the by-product itself is collected, the increased value of this most essential element of life under the present conditions must of necessity draw attention to continual advances being made along lines which break down all existing limitations. Looking still further ahead, it is not difficult to visualise the coming into vogue of entirely new ideas which, with the possibilities of a national electric supply, will, so far as furnace work is concerned, admit of doing away even with the necessity for coke at all; but it is of interest to know that, prior to the war, no German ironmaster had a bee-hive oven plant in operation, either for blast-furnace or reduction work.

I am convinced that there is coming a time when the barriers which national lethargy has built up must crumble away. Those who follow up the advances made in the spheres of electrochemical and electrothermic processes will need no reminder of the revolution many processes of present-day production must undergo if our industries are to hold their own, and "organised effort" has a great opportunity here. The chief thing which made Germany a most formidable foe lay in the recognition given to "thoroughness of efficiency" in industry, and mass intelligence control. I venture to think that one of the greatest compensations likely to result from the struggle will be a world-wide recognition of this principle, *not, however, as the German believed in it*, but as applied to constructive and regenerative processes of thought. Because of it, the aim of education must inevitably become more utilitarian than ever before, a greater attention must also be paid to vocational training, and a changed view on the part of a large section of the general public regarding the mechanical professions and allied trades must come about. The new conditions imposed upon commercial life will demand it, and the need for better trained men will be greater than ever. True co-operation and right organisation but need to be brought to bear upon our daily lives in order to obtain the maximum yield from the service rendered.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The 12½ per cent. Award and Clerical Staffs.

Having read in your last issue the letter from "Chief Clerk," may I also through your esteemed columns express my hearty support of his views, which I am sure are shared by the clerical sections of the technical staffs of all the supply companies and Borough Councils throughout the kingdom. It seems rather a pity that the Award was not framed in such a way as would leave no doubt that clerks, who, in the majority of cases, are relied on quite as much as the actual electrical assistants, were intended to participate in this bonus. Apparently at the present moment, the companies or public bodies are left with the option of either including or excluding the clerical side of the technical staff according to their own construction of the terms of the "Award," and, therefore, it is not surprising that the vast majority have adopted the latter, especially as the clerical profession are not likely to invoke the assistance of a Union to voice their demands, which is the reverse of the case if the manual workers in connection with electric supply work had been left out.

Seeing that this bonus is, I take it, to help pay the increased cost of living, there is, in my opinion, no good reason why clerks (who are also privileged to pay the present prices) should be left outside its scope.

I therefore hope that some official ruling will be given, in order that we clerks who are engaged on technical, statistical, and other work in connection with the generation or distribution of electricity for supply to private and public users, including munition factories, may be included in the Award in question.

I trust that you will use your good efforts on our behalf on this point, and, by doing so, you will earn the deep appreciation of a body of workers who have certainly been as hard hit in the matter of living expenses, &c., as any other section of the community, without having the opportunities to obtain redress such as are open to the manual workers in the electrical line.

One last point: as apparently men who act as storekeepers in generating or distributing stations benefit by the 12½ per cent. Award, how is it that men who act as clerks and storekeepers (but happen to be rated as clerks on the wages sheets, &c.) do not participate?

Another Chief Clerk.

February 15th, 1918.

British Water Power.

Regarding the article on British water power, in your issue of February 8th, while expressing my appreciation of the same, I would like to point out some omissions. The author has given England, Wales, and Ireland but scant attention: the impression is given that Chester possesses the largest water-power plant outside Scotland. This is not so, as the Aluminium Corporation have a 7,000-H.P. plant near Colwyn Bay, North Wales, and plenty of water is available for any extensions. The North Wales Power Co. have a 5,000-H.P. plant near Llanberis, the head in each case being about 1,000 ft.

Kiwi.

[Our abstract was necessarily very brief, and we do not think the author intended to convey the above impression: his point with regard to Chester was the successful utilisation of a low head on a river.—Eds. Elec. Rev.]

Examinations in "Electrical Installation Work."

As one of those whose age ranges between 15 and 60 years, as referred to by Mr. W. Ellerd-Styles in his letter of the 11th inst., I can only say that it is no fault whatsoever either of the South-Western Polytechnic or of the instructors if full advantage is not taken of the opportunities offered to the students, for I am convinced, speaking from practical experience, that these technical institutes are a real boon to anyone who wishes to learn, no matter what the subject may be. The only fault, so to speak, that one has to find with the institute is that it is not better known, and it is a matter of regret that the governing body do not take steps to this end.

What the percentage may be to which Messrs. Lundberg refer is a matter, of course, of which I have no opportunity of judging. but perhaps many of the students, especially some of the seniors, may not have joined the classes with a view to going up for examination.

Such are the advantages that these technical institutes offer, that I am convinced that it would be a good thing for the country and for the empire if every boy or man under a certain age working in a factory should be compelled to spend so many hours a week of his working time at one of the institutions, as thereby he would be able to gain a technical as well as a practical knowledge of his work, and that it should also be a regulation that every workman should pass his examination, and thereby be able to produce a certificate of his skill.

K. Warner.

London, S.W., *February 19th*, 1918.

Switchboard Passageways and "High Visibility."

I have a suggestion to hand on to those engineers who are concerned with the maintenance of main switchboards.

In a great number of cases the backs of the panels have a dull surface, nearly black in colour; with this as a background, efficient inspection and maintenance is rendered difficult to a degree. This state of things is common, but can be readily improved, at a small cost, by coating the exposed surface on the back of the panels with white enamel, the wall forming the other side of the passageway being treated in a similar manner if necessary.

There is at least one make of enamel which has a fine, hard gloss, and remains white for a long period; needless to say, the brushes used for the work should be non-metallic.

The improvement the above treatment effects is considerable; the nuts, lugs, &c., show up clearly and sharply against the white background, work is done better and more quickly, less artificial lighting is required, and the risk of accidents is minimised.

Chas. Cuthbertson.

Stoke-on-Trent, *February 18th*, 1918.

LEGAL.

Sulley *v.* Withers.

In the Lord Mayor's Court, on February 11th, before the Recorder (Sir Forrest Fulton, K.C.) and a jury, plaintiff, an auctioneer and surveyor, 46, Cannon Street, E.C., sued the defendant, Mr. Stephen Withers, East Sheen, to recover £46 10s. upon a dishonoured cheque given by the defendant for the purchase of certain lots of electric pocket-lamp batteries bought by him at an auction sale held by the plaintiff on November 26th last, at premises situate at 26, Tottenham Square, Tottenham Road, Dalston. The defendant raised a counterclaim for damages, and alleged that the plaintiff had been guilty of fraud, and that he had carried on a fraudulent system of business.

Mr. Morle, for the plaintiff, said that the facts of the case were quite simple, but the defendant had thought fit to place on record a grave and serious charge against the plaintiff. In the latter part of November last year the plaintiff, in the ordinary course of his business, was instructed by Mr. Grizard, of Tottenham Square, Tottenham Road, Dalston, to offer for sale, by public auction at his premises an assortment of articles that had been acquired in the ordinary course of business. Mr. Grizard was a buyer of odd and damaged stock. Plaintiff prepared a catalogue of the things to be sold, the sale to take place on November 26th. A copy of the catalogue reached the defendant some days before the sale. Amongst the articles for sale were 27,000 pocket-lamp batteries. Prior to the sale the goods were on view on Saturday, November 24th, from 10 a.m. to 3 p.m., and also on the morning of the sale, which was to commence at 11 o'clock. The auctioneer gave the plainest and fullest warning that intending purchasers must buy at their own risk. In the conditions of sale appearing in the catalogue, plaintiff also gave warning that intending purchasers must rely upon their own judgment in connection with their purchases. The catalogue bore the words: "A salvage sale of salvage goods." The defendant had examined the goods, and had said, in connection with the batteries, that although there were some "duds" amongst them, he should make a bid for them. The defendant attended the sale, the lots for which the cheque in question was given being knocked down to him some time in the afternoon of the day of sale. He bought three lots of 1,000 each at 1s. per 100. The batteries came from America, and instead of getting on the market through the usual channels, they received damage on the way and got into a salvage sale. The defendant did not clear the goods at once. Several days passed; no doubt, he (counsel) suggested, defendant was trying to find a purchaser for the goods. On November 30th defendant gave his cheque and proceeded to remove the goods. At the time of the removal, defendant had a conversation which showed he knew perfectly well he was buying a speculative assortment of goods. Four days later defendant complained that only a third of the goods were really effective batteries, and he refused to accept them. His cheque was returned dishonoured, being marked "R.D." That happened on December 4th, and on December 7th the present proceedings were brought. The defendant now set up that he ought not to be called upon to pay for the goods, because he was induced to give the cheque by the plantiff's fraud and by the fraudulent system of business the plaintiff carried on. That was the gravest allegation to bring against a man like the plaintiff, who had practised in the City of London for a number of years. The grounds for saying that the plaintiff was fraudulent were that the goods sold were not as shown, that the upper layers of goods contained 75 per cent. of effective and 25 per cent. worthless batteries, and that the underneath layers consisted almost exclusively of worthless batteries, which proved the goods were not as shown. Neither the plaintiff, counsel said, nor anybody in his employ, had anything to do with the packing of the cases, and they were sold in the same way as received. The defendant had alleged that the plaintiff's conditions of sale were obviously prepared to enable him to carry on a fraudulent system of business. The plaintiff's conditions of sale were similar to those to be found in all auction sale catalogues, and were framed to protect the auctioneer as much as possible.

After hearing the evidence, the jury sent an intimation to the Recorder to the following effect:—"My Lord, the jury are agreed that an auctioneer should not be held responsible for the condition of goods he sells. The defendant should pay for the goods, apologise and withdraw the charges he made."

Mr. Merlin, for the defendant, said he had evidence to put before the Court at the proper time, but he refused to do so before the present jury. It was useless, under the circumstances, to go on with the case, and he made an application for a new trial.

The Recorder said in that case he would take the verdict of the jury, which was for the plaintiff for the amount claimed, and for the plaintiff on the counterclaim.

An order was made that the costs on the counterclaim should be taxed on the scale above £50. A stay of execution was granted the defendant for seven days, to enable him to give notice of his intention to move for a new trial.

Alleged Electric Cable Detention.

In the High Court of Ireland, Dublin, Mr. Justice Gordon granted an application on behalf of the defendant for discovery of documents in an action by Messrs. Richard Farrell, Ltd., merchants, Goughal, against Mr. John Landy, Rathfarnham, Dublin, for the return of a quantity of electric cable, or for its value (£143), and damages for its detention. Counsel said the point at issue between the parties was whether the cable was sold to the defendant by an agent of the plaintiffs.

WAR ITEMS.

More from "Over There."—A Naval Officer, writing from the Orkneys, says:—"I wish to take this opportunity of again thanking you for sending me the Electrical Review so regularly. It is very much appreciated by us all, and serves as a connecting link between the present life and the profession we have temporarily left."

A technical correspondent with the R.F.C. writes thanking us for the E.R., which reaches him regularly every Monday. He adds:—"There are now 20 of us, all electrical men, billeted in one hut, and the pleasure that the arrival of the Review gives us cannot be exaggerated. I am in Blighty on leave. . . . I only hope that this will be the last leave I shall get, and that before the next one is due Peace will be proclaimed."

Exports to China.—The *London Gazette* contains a further list of persons and bodies in China to whom exports may be consigned.

Trading with the Enemy.—The *London Gazette* for February 15th contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Costa Rica, Greece, Guatemala, Hayti and Dominican Republics, Honduras, Morocco, Netherlands, Netherland East Indies, Nicaragua, Norway, Panama, Peru, Portuguese East Africa, Salvador, Spain, Venezuela.

Exemption Applications.—At Ashton-under-Lyne, last week, the application for exemption made by J. N. Bardsley (31, grade 3), electrician, Waterloo, was not assented to after April 15th.

Stratford-on-Avon Rural Tribunal heard a review of the case of Arthur Baldwin (40, B 1), electric light attendant for Mr. J. Fielden, of Kineton House. On November 16th last the case was put back for the military to provide a substitute, and one has not yet been found. Mr. Fielden said that the man provided the current for the war hospital. Major Neilson said that the question of substitution was now out of his hands and rested with the employer. He suggested that the man's place should be filled by a man of lower category. Two months were granted to see if a substitute can be obtained.

At Torquay, an appeal was made by Geo. Davis (33), tramway storekeeper, who was said to be absolutely unfit for military service owing to heart affection. The appeal was respited for a further medical examination.

At Truro, G. H. Lear (24, Grade 2), electrical engineer, applied to go before the Central Medical Board for re-examination. He said that the local Medical Board took no notice of his doctor's certificate. The Tribunal granted the request, and gave exemption until March 1st.

The East Sussex Appeal Court has disallowed a military appeal against exemption until March 14th granted to a Brighton electrician aged 30.

At Hastings, Mr. V. W. Edwards, manager of the tramways, applied for leave to renew an appeal for an employé named

Tapsell, whose category had been lowered from A 1 to Grade 2. The chairman said that the distinction was a small one, and leave would be refused. A motorman was, on the recommendation of the military, allowed three months' conditional exemption.

At Cambridge, the National Service Representative appealed against exemption granted to W. O. Pilgrim (40, Grade 1), electrician, with Messrs. Bailey, Grundy & Barrett, electrical engineers. It was stated that the man was putting in practically his whole time at the gas works, where work of great importance was done by electricity, and unless the firm had a competent electrician it would be a very serious matter for the town, the military hospitals, and the railway. Pilgrim was directed to join up by May 1st.

At Wolverhampton, six employés were appealed for by the manager of the Corporation tramways. Two, who are Reservists, were given conditional exemption; the others were directed to go before the National Service Medical Board.

At Cirencester, Major R. A. Scott, of Hatherop, appealed for the retention of F. J. Turrill (37), electrician. He served seven years in the Navy, but had been three times rejected for the Army since the outbreak of war. The Tribunal ordered a medical examination.

On appeal of the manager of the Corporation tramways, Mr. Lambert, the Maidstone Tribunal has granted six months' exemption to A. E. Chittenden (33, B 2), spare driver, and three months to F. Rose (37, Grade 3), a regular driver.

ELECTRIC POWER SUPPLY.

We have received from Mr. H. Faraday Proctor, hon. secretary of the Incorporated Municipal Electrical Association, a copy of the following statement, which has been agreed by the Council of the I.M.E.A. in conjunction with the Association of Municipal Corporations. The statement has been forwarded to the Secretary of the Board of Trade Electric Power Supply Committee, with the comment that while it represents the views of the Council, the membership of the Association includes many of the smaller undertakings, which may not be in agreement with the whole of the views set forth:—

Electric Power Supply.—Statement.

1. To ensure that there shall be an adequate and economical supply of electric power it is necessary that the areas of supply, instead of being local government areas, should be areas specially delimited as areas suitable for electric supply, having regard to demand and facilities for obtaining suitable sites for generating stations. The application of this principle must depend upon the local circumstances, including the position of existing supplying and distributing authorities, and the facilities possessed by them and their liabilities and obligations.

2. Different considerations will apply to generation and distribution, and these need not in all cases be in the same hands. Generation should be on a large scale, and extend over a considerable area. Distribution which includes dealing with individual consumers may conveniently be organised in smaller areas.

3. The new areas, both for generation and distribution, should be continuous, and will in many cases include within their limits places which at present are without a supply, either because no powers exist there, or because existing powers have not been exercised.

4. Having regard to the paramount requirements of an adequate and economical supply, the best use possible should be made of existing systems of generation, transmission, and distribution, and also of the local knowledge obtained by established undertakings. The suggestions which follow are put forward as alternatives to be moulded in each case by the Central Authority, according to the circumstances.

5. In many cases a joint board might be established for the generation of all the energy required in a large area, and for the transmission of such energy by means of trunk mains, leaving the distribution to be effected locally. This board should comprise representatives of all the local authorities supplying electricity within the area in question, and all the existing generating plant and transmission mains would be transferred to it. It would have power to raise capital, either by means of a precept on the constituent authorities or by borrowing on the credit of its undertaking and of the rates levied by those authorities.

The distribution areas would not necessarily be identical with existing supply areas, as ground might have to be covered which is not now within the area of any supply authority. It is suggested that existing supply authorities might undertake the distribution within larger areas than their present ones.

6. The following alternatives, which have been adopted with excellent results in the supply of water and gas, may be found solutions to the problem in certain cases:—

(*a*) Where there is a large undertaking which is detached or isolated from other large undertakings, with a number of small undertakings in the neighbourhood possessing their own separate sources of supply, the object would be attained by facilitating an extension of the large area for the purpose of the generation and transmission of energy, so as to include the small areas, and by transferring to the large undertakings upon fair terms the generation and transmission systems of the small undertakings. The distribution, including the areas now without supply, would be carried out locally either by the existing authorities or by the large authority. The remarks as to distribution areas in paragraph 5 would also apply in this case.

(*b*) A new authority might be established similar to that outlined in paragraph 5 to carry out the generation, transmission, and distribution of electrical energy throughout a large area, acquiring on fair terms all the existing interests within such areas.

7. When the whole or a portion of an existing undertaking is transferred to a larger authority, suitable provision would be made in regard to the rights and obligations of existing undertakings, the capital commitments and the responsibilities towards any officers whose status or remuneration would be affected.

8. In our opinion it would be a fatal mistake to depart from the principle upon which Parliament has acted, with very few exceptions, for many years past, that undertakings of this description, which involve a monopoly, and upon which the prosperity of the people depends so largely, should be entirely in the hands of the public authorities.

9. These proposals would be complicated in districts which are now partly supplied by companies. With the exception, however, of London, and of an area on the North-East Coast of England, there are very few places where undertakings of any size are vested in companies, and probably where there are such undertakings the best course would be for the joint board or the extended municipal undertaking referred to in paragraph 5 to acquire them upon fair and equitable terms.

10. The questions of London and the North-East Coast require special consideration, and the foregoing observations are not intended to apply to them.

11. We have also considered the question of a Central Government Authority, and, whatever may be the ultimate form or constitution of the authority, we think that, in view of the many important decisions to be made in the immediate future, and the new duties and powers which will fall to be administered, it should be strong on the technical and inspectorial sides. We consider also that whatever central authority is entrusted with such work, it must be responsible to Parliament.

Standing Conference of Electricity Supply Associations.

Mr. Proctor also notifies us of the formation of the conference above-named, which has been established so that there may be one single body representative of the whole of the electricity supply undertakings throughout the Kingdom, whether municipal or company owned. The conference is constituted as follows:—

The Incorporated Municipal Electrical Association, representing 196 municipalities.

The Conference of Chief Officials of London Electric Supply Companies, representing 13 companies in London.

The Incorporated Association of Electric Power Companies, representing 11 power companies in the provinces.

The Provincial Electric Supply Committee of the United Kingdom, representing provincial companies.

The conference will deal with matters relating to conditions of employment, the rates of remuneration of staff and employés, and other matters of general concern.

BUSINESS NOTES.

Combination Rumours.—According to several newspapers, negotiations are reported to be in progress for an important combination of big shipbuilding, armour plate, and iron and steel interests. Companies named are Vickers, Beardmores, and several concerns on the North-East Coast and in the Midlands. It is expected that the capital will amount to a huge figure, and that the combine will have far-reaching effects.

Sweden.—The Swedish General Electric Co., of Stockholm, has recently acquired control of the business of the Swedish Ljungstrom Turbine Works Co., of Finspong, having purchased the majority of the shares of the undertaking.

Depreciation of Machinery.—In reply to a question asked in the House of Commons by Mr. George Terrell, Mr. Bonar Law said:—The income-tax allowances in respect of the depreciation of machinery and plant fall to be determined not by the Commissioners of Inland Revenue but by the respective bodies of Income-Tax Commissioners upon whom it devolves to allow such deductions as they may think just and reasonable.

Liquidations.—Vaughan Engineering Works, Ltd., 22, Cross Street, Islington.—First meetings of creditors and contributories, March 1st, at 38, Carey Street, W.C. 2.

Balcke & Co., Ltd., 27, Clement's Lane, London, E.C.—On the petition of the Board of Trade for the winding up of this company under the Trading with the Enemy Act, Mr. Justice Younger in the Chancery Division on Tuesday said it was desirable that there should be a winding-up order. He made the usual order allowing the costs of the company.

Plant for Sale.—Swindon Corporation electricity and tramways department has for disposal one 300-kw. generating set, consisting of a Davey-Paxman triple-expansion engine coupled to two 150-kw. d.c. dynamos.

Basingstoke Corporation electricity department has a small electrical plant for disposal. Particulars are given in our advertisement pages to-day.

Catalogues and Lists.—Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1. Thirty-two-page catalogue containing very full and illustrated descriptive and other matter relating to their patent coking stokers. The latest improvements are summarised, and notes are given on the methods of operation, also particulars of test results. Copies of the catalogue will be forwarded on application to the firm.

Messrs. British Utilities, Ltd., 148, South Park Road, Wimbledon, S.W. 19.—Leaflet giving prices of batteries for pocket lamp, bell, and other service.

Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock-list of standard shunt-wound ventilated motors. Such a list is to be issued monthly.

The Key Engineering Co., Ltd., of Trafford Park, has issued a vest-pocket celluloid calendar for 1918.

"Scholey's Magazine" for January contains interesting opening notes on amalgamations in industry, the status of the engineer, and other subjects. Descriptions are given of the "Kutmor" electric drills and grinders, the "Premier" electric suction cleaner for factory service, and other Scholey manufactures. The objects of the Industrial League are stated, and its progress is reviewed.

Messrs. Ward & Goldstone, Salford.—Circular giving illustrations of a range of assembled cables and cords with various terminal ends, manufactured by them for all purposes.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Bolton.—The public examination was fixed for February 13th, at the Court House, Bolton, but was adjourned. The Official Receiver (Mr. Gibson) said debtor had submitted a proposal for a composition, and the public examination could not be concluded until the meeting of creditors had been held and closed. The meeting of creditors had been adjourned for a month, so the examination must also be adjourned.

George Edward Hipkins, electrical engineer, 48, Wolverhampton Street, Dudley.—Last day for receipt for proofs for dividend, March 5th. Trustee, A. M. Fairbairn, 1, Priory Street, Dudley. An application was made at the Court House, Dudley, recently, for the discharge from bankruptcy of the above-named debtor. It appeared that the ranking liabilities were £510, and the assets amounted to £151, and a first and final dividend of 3s. 3¾d. in the £ had been paid. The debtor commenced as an electrical engineer in January, 1913, and in September, 1913, went into partnership with another in another business at Dudley Port. The Official Receiver reported that the debtor's assets were not equal to 10s. in the £ on the amount of his unsecured liabilities, that he had omitted to keep such books of account as were usual and proper in the business, and that the debtor had brought about, or contributed to his failure, by rash and hazardous speculation and neglect of his business affairs. The Official Receiver stated that since the report had been filed debtor's friends had offered to pay £100 on his behalf, which would make up the dividend to 10s. in the £. Debtor had served in the Army for over two years, and had been wounded. His Honour granted the application for discharge, and judgment was entered against the debtor for £100.

An Electrical Amalgamation.—The following statement appeared in the *Times* "City" column on February 15th:—

"We learn that the rumours which have been in circulation regarding the acquisition by the General Electric Co., Ltd., of Fraser & Chalmers, Ltd., are well founded. Negotiations have been in progress with the object of amalgamating the two businesses, but they have not, we understand, yet reached a stage at which an official statement can be made. Such a fusion would no doubt enlarge the scope of operations of the General Electric Co. and its associated enterprises, and might indeed form an important link in the scheme for placing the electrical industry in this country on a footing which would enable it to compete advantageously with foreign manufacturers after the war. Fraser & Chalmers are the well-known manufacturers of mining and other machinery, and have an established connection with the principal mining fields. The company was originally formed to acquire the control of an American company, but in 1901 the American business was disposed of."

We may state that what has happened is this:—The General Electric Co., Ltd., has purchased the works and entire establishment of Fraser & Chalmers, Ltd., at Erith, and will add to its already wide range of electrical engineering manufactures turbines, coal-conveying and gas-cleaning apparatus, and steam boilers. The whole of the Fraser & Chalmers business thus becomes transferred to the General Electric, with the exception of the gold-mining equipment, which will be continued by Messrs. F. & C. A further interesting development is the purchase by the G.E.C. of a controlling interest in the well-known electricity meter manufacturing firm of Chamberlain & Hookham, Ltd. The latter firm will operate under the same name as hitherto, and will be conducted as a separate company.

Trade Announcements.—The Century Electric Co. have removed from No. 14 to No. 28, Brown Street, Manchester.

Messrs. Ferranti, Ltd., are to-day vacating their Kingsway offices and taking up temporary quarters at 57, St. John's Square, Clerkenwell Road, E.C. 1. New telephone number: Holborn 1018.

Book Notices.—*The Silewani-Ghat Hydro-electric Power Project in the Chhindwara District.* By E. Batchelor, I.C.S. Allahabad: Pioneer Press. Price 2 rupees.—In this brochure the author deals with the possibility of developing a very large amount of power at a low cost, in the neighbourhood of Chhindwara, which is situated in the Central Provinces of India. He details various purposes to which the power could be applied, citing numerous authorities for his data, and describes the characteristics of the district relevant to the subject, with estimates of the cost of the works, which involve the construction of a good many storage reservoirs, pipe-lines and canals, and separate generating stations. The total power available is stated to be nearly 70,000 KW., and the total cost of the power plant is put at 65,23,740 rupees, or Rs. 93 per KW. The cost of reservoirs, canals, and pipe-lines, with a small allowance for compensation to landowners, is estimated at Rs. 2,62.70,000, bringing the aggregate outlay up to Rs. 3,27.93,740, or Rs. 470 per KW. The revenue at ·2 anna per unit would be Rs. 77,00,000, the working costs Rs. 6,80,000, and the profit Rs. 70,20,000 per annum.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI. No. 271. February, 1918.—This issue contains the following papers:—"The Pros and Cons of the Metric System," by Mr. Ll. B. Atkinson; "A Case for the Adoption of the Metric System," by Mr. A. J. Stubbs; "Electrical Signalling and Control of Railways," by Mr. C. M. Jacobs.

"Science Abstracts." A and B. Vol. XXI, Part 1. January 31st, 1918. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each net.

Messrs. Henry Sotheran & Co. have issued a catalogue of rare and standard books on "Exact and Applied Science" (price 2s. 6d. net), including the scientific portion of the library of the late Lord Justice Stirling, George Rennie, Samuel Roberts, and other well-known scientists; the catalogue (which cannot be sent gratis, owing to Government restrictions) comprises 250 pages, of which some 22 are devoted to "Engineering."

"Tables of British Decimal Coinage, Metric and British Weights and Measures, &c." By A. J. Lawson, M.Inst.C.E. London: Eyre and Spottiswoode, Ltd. Price 5s. net.

LIGHTING AND POWER NOTES.

Barnsley.—Plant Extensions.—The T.C. has adopted the recommendation of the Electricity Committee as to the granting of the 12½ per cent. bonus in addition to the 20s. to the various grades in the electricity department. In moving the adoption of the minutes Alderman Rose, in referring to the wages advances, said he was afraid the financial balance of the department would be on the wrong side at the end of the year. If the Council adopted the suggested scheme of extension the total cost of the undertaking would be £76,000, that would enable the Committee to produce 4,800,000 units per year compared with only two million units in 1912, when the debt was £68,000.

Bath.—The E.L. Committee has authorised the sale of the Diesel engine set, owing to the load having outgrown the capacity of the machine, and to the prohibitive price of oil fuel. It is proposed to obtain turbine plant to replace it.

Bedworth.—Street Lighting.—The Parish Council has decided to ask the Electric Power Co. for an estimate for the lighting of the whole of the street lamps for a period of 12 months.

Belfast.—The Special Committee appointed to inquire into the working of the Corporation tramway and electrical undertakings has recommended that the present single Committee system be discontinued, and that one Committee be formed for the tramway and another for the electrical undertaking. The approval of the Corporation is a foregone conclusion.

Birmingham.—Rate Relief.—As a result of the conference last week on the question of the amounts the trading departments of the Corporation should make to the relief of rates fund for the ensuing year, the following contributions will be made:—Gas department, £30,000; electric supply, £25,000; tramways, £25,000; against this there is a deficit of £120,000 on the water undertaking, the balance being provided by the general rates.

Blackpool.—Price Increase.—The Electricity Committee, last week, decided that a further 5 per cent. be added to electricity consumers' accounts, to come into force on April 1st. This is due to the general increase in the cost of production, and notably in coal and wages.

Bray (Co. Wicklow).—Tar Oil.—On a report from the electrical engineer as to shortage of petroleum supply, and the risk of having to close down the day supply of current during the summer months, the Council decided to order tar-oil apparatus.

Buxton.—A Committee formed by the T.C. to consider the condition of the electricity undertaking recommends the installation of a gas-driven generating plant, and gradually to dispense with the existing steam plant; the provision of a battery approximately double the size of the present one, the provision of a new engine-room gallery and switchboard, a complete equipment of working tools to enable repairs to be done on the premises, the disposal of an unused generating plant, a disabled gas engine, and obsolete fittings and sundries; the erection of feeder pillars; the substitution of the present public lamp fittings by more serviceable and efficient lanterns; and the establishment of a showroom at the Town Hall. The utilisation of water power at the works, and the possibility of obtaining energy in bulk from Manchester, are also to be considered.

Colchester.—In order to bring the prepayment consumer up to the level of other consumers who are paying an increased 10 per cent. for current, the T.C. has decided to discontinue the free supply of lamps, and to levy a meter rental of 6d. per quarter as from April 1st.

Continental.—SPAIN.—La Sociedad Catalana de Gas y Electricidad has secured a concession to establish a plant to utilise the water power of the River Ecera, near Seira (Province of Huesca), in the generation of electrical energy for lighting and power purposes.

SWEDEN.—The A.B. Jungers Elementbelysning Bolag is the name of a new company which has lately been formed in Gothenburg with a capital of about £83,000 to undertake the establishment of electric lighting plants in small towns, country houses, farms, &c.

Devizes (Wiltshire).—The T.C. has appointed a Special Committee to consider the question of lighting the town by electricity after the war.

Dublin.—PLANT EXTENSIONS.—The Council has adopted the report of the Electricity Committee recommending that application be made to the L.G.B. for Ireland for sanction to a loan of £175,000 for extensions to the electricity undertaking, as detailed in our last issue. A lengthy discussion took place on the matter, and it was pointed out that in 1916 Mr. P. W. D'Alton had advised the necessity of providing modern plant, with which the Corporation's engineers agreed. Mr. Sherlock, the newly-elected chairman of the Electricity Committee, rather doubted whether they would get the loan under present conditions, but if not, the responsibility would not be theirs.

Dundalk.—Mr. P. A. Spalding, electrical engineer to the Council, reported, last week, that during the year ended December 31st last the total number of units generated at the power station was 1,106,919, of which 518,918 units were for the Great Northern Railway (Ireland) supply, the balance being for town supply and Council purposes on the premises. The engines had been adapted, at a cost of £985, for the burning of tar oil. This expenditure had enabled a saving to be made during the year of £1,905, while the saving during the present year was anticipated at not less than £2,500. A detailed table was submitted showing the loss on the supply to the Great Northern Railway in consequence of a delay of 14 months in starting the main agreement, and of further loss in the subsequent carrying out of the agreement due to the Council's working expenses being considerably in excess of the original estimate, which was based on pre-war figures. The income of the undertaking for the nine months to December 31st last marked an increase of £1,450, but the cost of fuel and lubricating oil alone had increased by £1,305 as compared with the corresponding period of 1916.

Dundee.—Negotiations have taken place regarding an electricity supply for the new shipyard of the Caledon Co. The latter proposes erecting a sub-station and coverting its own supply; the station is to cost £7,000.

Ealing.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity from March next as follows:—Private lighting, flat rate (6½d.), to 8d. per unit, and for all other methods of charging in proportion; public lighting in proportion: cooking and heating, from 1½d. to 1¾d. per unit.

Fochabers.—A new installation has been completed at the power station on the River Spey for the Gordon Castle estate. The new set comprises a Crossley crude oil engine of 132 B.H.P., together with an 80-KW. G.E.C. belt-driven dynamo. The engine is supplied with two compressed-air starters, and can take a temporary overload of 20 per cent.

Gloucestershire Electric Power Co.'s Bill.—The Nailsworth U.D.C. has decided to join with other neighbouring public bodies in opposing the above Bill: the Stroud U.D.C., in order to protect the interest of the ratepayers, has decided to oppose the Bill jointly with the Gloucestershire C.C.

Greasborough.—PROV. ORDER.—The U.D.C. has entered into an agreement with the Rotherham Corporation whereby the Council is, amongst other things, withdrawing its application to the B. of T. for a prov. order, and has agreed to support the Corporation's application. If the Corporation's Bill is approved by Parliament, electricity will be supplied in the Council's area at the same price as that charged to Rotherham ratepayers and residents.

Hereford.—PRICE INCREASE.—The price of current for lighting has been increased by an additional 10 per cent., and that for power from 35 to 45 per cent., as from the end of the December quarter.

Hove.—PRICE INCREASE.—The Electricity Committee has adopted a scale of increased charges for lighting and power; the Aldrington rates are also increased.

Kilmarnock.—The T.C. has agreed to pay Sir Alex. Kennedy 100 guineas for a report on the electrical undertaking and 100 guineas as a retaining fee as expert adviser.

King's Lynn.—PLANT EXTENSION.—The electricity department has paid the 12½ per cent. bonus to the employés of the electricity department. It was decided to undertake extensions to the electricity works, at an estimated expenditure of £15,000, subject to the necessary powers being obtained, provided that an agreement for a supply of power was entered into with the British Farma Mills Co., who propose to establish works in the town.

Limerick.—The machinery for the erection of electric cranes at the quays has been maliciously damaged, and a special force of police was last week detailed to protect it.

London.—The Stoke Newington and Shoreditch B.C.'s have agreed to give the 12½ per cent. bonus to their employés.

Londonderry.—At a meeting of the Corporation Lighting Committee it was stated that the estimated revenue for the current year from the city electrical undertaking was £26,347, and that the output and income had increased in the past seven years by 300 per cent.

Manchester.—RATE RELIEF.—The Special Committee of the Corporation appointed to consider the basis on which the various trading committees should make contributions to the aid of the city rates, has issued its report. It recommends that the actual surplus profits of the electricity, gas, and tramway departments be paid over to the city fund, with a fixed minimum of 1 per cent. upon the aggregate capital expenditure of the electricity undertaking, 1 per cent. upon the gas undertaking, and 5 per cent. upon the tramways. The capital expenditure upon the electricity undertaking up to March last was £3,165,134, making the suggested minimum £31,651, and on the tramways £2,237,827, the suggested 5 per cent. minimum upon which is £111,891.

Midlothian.—An outbreak of fire, on Sunday, destroyed the electric power station and air compression engine house at Dalkeith Colliery, Smeaton.

Montrose.—ELECTRICITY PRICES.—The Electric Light and Power Co. has applied to the Council for permission to increase the charges for electricity other than for street lighting by 10 per cent. The town clerk was instructed to obtain information as to the charges in towns similarly situated.

Runcorn.—PROPOSED SUPER-POWER STATION.—According to the daily Press, the Mersey Power Co., of Runcorn, which is a subsidiary of the Salt Union, Ltd., has decided to erect a large new power station in proximity to the existing station at Weston Point. The immediate provision of 25,000 H.P. is suggested, with eventual development to 130,000 H.P., with the object of supplying local industries. At present a 6,000-H.P. plant is in use. It is understood that the Ministry of Munitions favours the scheme.

South Africa.—The Paarl (Cape Province) Municipality proposes to borrow £2,200 for the purpose of extending the electric lighting system in the streets.

DURBAN.—An accident of a serious nature recently occurred on the Bluff, when one of the camp natives sustained horrible injuries. In spite of a warning which had been previously given, he had attempted to get through a live electric wire fence, receiving dreadful burns, and a severe shock.

The Cape Town Council is to hold a ratepayers' meeting for the purpose of obtaining consent to an expenditure of £180,550, viz., £95,610 for generating plant, £68,000 for distribution purposes, and £16,940 for workshops.

Tottenham.—STREET LIGHTING.—The North Metropolitan Electric Supply Co. has suggested to the U.D.C. that the street arc lamps should be removed, and incandescent lamps substituted therefor. The substitution of incandescent lamps will give effect to the Council's wishes, and the engineer reports that a saving of over £1,000 per annum will be effected. The altered system of lighting is to be agreed to, and the engineer is to make the most favourable terms possible with the company.

United States.—The first section of the new power station of the Public Service Co., of Northern Illinois, near Joliet, which has recently been completed, is of interest because of the high steam pressures employed, which makes possible a higher over-all plant efficiency by increasing the upper limits of the thermal cycle. The initial plant consists of two 10,000-KW. (12,500-K.V.A.), 12,000-volt, 1,800-R.P.M. turbo-alternators, with three cross-drum Babcock boilers: the latter operate at 325-lb. pressure, and supply steam at about 300-lb. pressure at the turbine stop valve, superheated 225°, giving a steam temperature of 650° F.

The boilers are of standard type but of heavier construction; the drum plates are $1\frac{5}{16}$ in. thick, the longitudinal seam being a butt and double cover strap quadruple riveted joint. The high-pressure steam piping is extra-heavy and of relatively small diameter, owing to the density of the steam; on pipes above 4 in. bore a special bolted joint with a welded seal at the periphery is used, and fittings of cast or forged steel. Integral superheaters are fitted to the boilers, and economisers with wrought steel headers and galvanised drawn steel tubes are built over the latter, the gases passing through an induced draught fan to the stack. Two chain grates are fitted in a common furnace to each boiler; each 1,000 sq. ft. of boiler heating surface has 23·4 sq. ft. of grate, 313 sq. ft. of superheater, 678 sq. ft. of economiser, and 3·8 sq. ft. of stack.

Wakefield.—The electrical engineer having recommended certain extensions at the electricity works, the Ministry of Munitions and the L.G.B. are to be interviewed.

Warminster.—PROV. ORDER.—The B. of T. has extended for another year the prov. order for electric supply.

Weymouth.—As the result of inquiries, the Electricity Committee is satisfied the employés of the electricity department are entitled to the 12½ per cent. award, and has adjusted the rates of pay accordingly.

TRAMWAY AND RAILWAY NOTES.

Bradford.—At the inquest, last week, on the body of Wm. Gill, driver of the Corporation tramcar which jumped the metals and overturned on a hill on the Allerton route, it was stated that the car was the one which had been blown over by the wind in 1913, but had since had new brakes and a new under-carriage fitted. The brakes were found to be quite in order after the accident. The driver was pinned underneath the car and died. The jury, in returning a verdict of "Accidental death," thought the accident was due to miscalculation by the driver owing to the darkness and fog, and thought there ought to be more light at such a point in the dark early mornings.

Continental.—Switzerland.—New locomotives have been constructed by Messrs. Brown-Boverie & Co. for the Jungfrau Railway. The line has 6·2 km. of section, operated by cogged wheels, and 3·2 km. by ordinary adhesion. The locomotives have to draw trains of 35 tons at 8·5 to 9 km. per hour on the cog-wheel sections, and at 18 km. per hour on the remaining sections. When descending, electric braking is used, the current being returned to the line. The locomotives have two axles; the electric equipment consists of two slip-ring induction motors of 125-h.p. hourly rating, and 350-h.p. maximum rating. The electric braking is ensured, even in case of the trolley not making contact, by the provision of a direct-current series machine. This machine excites two phases of the stator of the motor, so that it operates as a synchronous generator delivering current to resistances. By this means speeds of 6 to 9 km. an hour may be maintained on the cog-wheel section, and 12 to 18 km. an hour on the remaining sections. An air turbine is provided to cool the resistances. This machine is coupled to a 13-h.p. squirrel-cage induction motor and to a 6-kw. compound-wound direct-current machine, the latter being provided for supplying current for braking and lighting in emergencies. The locomotive weighs 18,020 kg., and the electrical equipment 10,000 kg.—*Zeit. des Ver. Deutscher Ing.*, December 22nd, 1917.

Glasgow.—For the period from June 1st, 1917, to February 2nd, 1918, the receipts of the Glasgow tramways have been £932,519, an increase of £103,453 as compared with the preceding year. The number of passengers was 285,654,286, as against 258,893,237 for the previous year, showing an increase of 26,761,049.

Harrogate.—Electric Vehicle.—The T.C. has approved a decision of the Highways Committee to purchase a 3½-ton electric tipping wagon, subject to the grant, by the Ministry of Munitions, of a priority permit.

Middlesbrough.—Tramway Purchase.—At a meeting of the T.C. on the 12th inst., the General Purposes Committee recommended the Corporation to exercise its right to purchase that portion of the tramways undertaking belonging to the Imperial Tramways Co. situated in the borough, and that notice be served on the company. This was agreed to, and a Committee, with powers to take the necessary steps, was appointed.

Rochdale.—Electric Vehicles.—The Cleansing Committee has provisionally agreed to the purchase of three electrically-driven lorries.

Southport.—Fares.—The Tramways Committee recommends an increase of all fares by one farthing per journey, a proportionate increase on return tickets, and reduced fare tickets for children under 15 years of age.

An application from the Amalgamated Society of Tramway and Vehicle Workers for an increased war bonus, with 21 days' notice of the withdrawal of labour, has been received by the Tramways Committee and referred to the Wages Committee.

The report for the year ending March last of the Corporation tramways, just issued, shows a net profit for the year of £719, as against £909 for the preceding year.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" to-day.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump. Director of Navy Contracts, Melbourne.

Belfast.—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" to-day.

Cavan.—March 4th. B. of G. Storage battery, wiring, electrically-driven pumps, pipes, &c. See "Official Notices" February 15th.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

Portsmouth.—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" to-day.

Warrington.—February 26th. Electricity Department. Steam pipework. See "Official Notices" February 8th.

March 5th. Electricity Department.—E.H.T. switchgear. See "Official Notices" February 15th.

CLOSED.

Barnsley.—Electricity Committee. Accepted tender, Babcock & Wilcox, Ltd., £3,900, for a water-tube boiler.

Glasgow.—The T.C.'s Electricity Committee recommends the acceptance of the following offers in connection with the new generating station at Dalmarnock :—

Turbine, condensing plant, alternator and transformer. Dick, Kerr and Co., Ltd., £98,400.

Supply and maintenance of storage batteries :—

Premier Accumulator Co., Ltd. £4,778 for batteries, and £289 per annum for maintenance.

The engineer has been authorised to extend the contract with Messrs. Reyrolle & Co., so as to include the supply of switchgear required in connection with the additional generating plant already referred to.

Edison Accumulator Co., Ltd—Five-ton electrical motor vehicle, £1,740.

London.—Metropolitan Asylums Board. Accepted tender, Rhodes Motors, Ltd., at £20 13s. 6d., for the installation of an electric motor at Queen Mary's Hospital.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, February 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Greenock Electrical Society.—Saturday, February 23rd. At 2.30 p.m. Visit to Merino Mill.

Illuminating Engineering Society.—Tuesday, February 26th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 5 p.m. Paper on "A Survey of Methods of Directing and Concentrating Light," by Lieut. Commander H. T. Harrison.

Royal Institution of Great Britain.—Tuesday, February 25th. At 3 p.m. At Albemarle Street, W. Lecture on "A National Laboratory of Industrial Research," by Sir R. T. Glazebrook, F.R.S. (Lecture I.)

Saturday, March 2nd. At 3 p.m. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S.

Association of Electric Station Engineers.—Wednesday, February 27th. At the Y.M.C.A., Albion Place, Leeds. At 7 p.m. Inaugural meeting. Addresses by Messrs. Lunn & Thomas (Manchester Section).

Royal Society of Arts.—Wednesday, February 27th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "Organisation of Commercial Intelligence," by Sir W. H. Clarke.

Institution of Electrical Engineers.—Thursday, February 28th. At 2.30 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Private and informal meeting for the purpose of discussing the provisions of the Patents and Designs Bill.

(**Manchester Local Section**).—Tuesday, February 26th. At 7 p.m. At the Engineers' Club. Paper on "Large Batteries for Power Purposes," by Mr. C. C. McKinnon.

(**Students' Section**).—Thursday, February 28th. At 7 p.m. At the Northampton Polytechnic Institute. Paper on "The Testing of Pyrometers," by Mr. R. Gates.

Salford Technical and Engineering Association.—Saturday, March 2nd. At the Royal Technical Institute. At 7 p.m. Paper on "Road Transport," by Mr. H. Dodgson.

NOTES.

New Electrical Industries for After the War.—With reference to the Engineering Trades' (New Industries) Committee appointed by the Ministry of Reconstruction, we learn that a number of Branch Committees, each of which will consider a certain trade or group of trades, has been set up. Mr. John Taylor (of Messrs. Mather & Platt, Ltd.) has been appointed chairman of the Electrical Branch Committee. Any reader who has specific recommendations to make under the terms of reference concerning the electrical industry, should address communications as follows :—Mr. John Taylor, Chairman Electrical Branch Committee, Room 114, Armament Buildings, Whitehall Place, London, S.W. 1.

Inquiries.—Makers of the "Falco" electric cooking apparatus are asked for.

Concert.—On Saturday last, the new recreation hall, with seating capacity for 700, which the directors of the Sterling Telephone and Electric Co. have built and equipped with an organ and grand piano for their employés at their Dagenham Works, was crowded with an enthusiastic audience, who greatly appreciated the talented artistes whom Mr. Guy Burney, as managing director of the company, on behalf of himself and his co-directors, had engaged for a grand evening concert to signalise the opening of the hall, which contains a fine stage with footlights. The electric lighting was carried out by the electrical department of the works. In addition to well-known artistes, the Sterling Orchestral Society (conductor, Mr. H. G. Smith) gave excellently-rendered selections, and the wealth of talent which abounds at the works was also freely drawn upon. Mr. H. Nicholls was a capable stage manager, Mr. A. W. James (assistant works manager) was an able M.C., and Mr. E. Gordon Lloyd (chairman of the Sterling Athletic and Social Club) a ubiquitous chief steward.

During the evening, Mr. Guy Burney made a brief speech, and a vote of thanks was enthusiastically passed to him and to the directors.

Electrical Power Engineers' Association (The Reconstructed A.E.S.E.).—Mr. F. B. O. Hawes, hon. sec., the Electrical Trades Benevolent Association, has been asked to address the above Association at its March meeting.

Applications from senior engineers above the rank of engineer-in-charge continue to come in, and to date the Association includes 45 chief assistants and chief technical assistants among its members.

A Selection Committee has been appointed, consisting of mains engineers and charge engineers from company undertakings, and chief assistants and mains engineers from municipal undertakings.

Mr. H. W. Mortimer has been elected representative for Croydon on the Council of the Association.

An ordinary Council meeting will be held on Thursday, March 14th, at 7 p.m., at St. Bride's Institute, Fleet Street, E.C.

The A.E.S.E. in Sheffield and District.—A general meeting of the above was held in Atkinson's Café on Monday, February 11th, 1918. The following resolution was adopted:—"That a local section be formed and attached to the Manchester Branch." A Committee was afterwards elected by the members present. By the enthusiasm which was shown, and according to promises made, it is anticipated that there will be a substantial addition to the membership by the time of the next general meeting, which will be held in the course of a week or so.

Atmospheric Nitrogen Production in England.—Sir L. W. Evans states that important developments have been made in Allied and neutral countries in the fixation of atmospheric nitrogen, and that considerable supplies are becoming increasingly available. It is believed, he says, that enemy countries are now relying entirely on this source of supply for the production of explosives. Arrangements have been completed by the Ministry of Munitions for similar production on a large scale in this country, and it is probable that, in order to save tonnage and owing to the length of the voyage from Chile, it will be found necessary to develop this policy still further. This source of supply is also expected to be of great value after the war for the production of fertilisers.—*The Times.*

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 2nd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. P. Bowden.

Next for Duty.—Lieut. W. J. A. Watkins.

Monday, February 25th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, February 26th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, February 27th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, February 28th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 1st.—Musketry, 5.30—8.

Saturday, March 2nd.—Entrenchments, &c., for the whole corps, 2.45—4.45. Recruits, 2.45—4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Foreign Trade.—The January Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	January. 1918.	*Inc. or dec.*
Imports.		
Electrical goods	130,947	+ 12,015
Machinery	686,868	— 13,850
Exports.		
Electrical goods	135,684	— 144,249
Machinery	1,263,235	— 216,896

The A.S.E. and Man Power.—The voting of the Amalgamated Society of Engineers, on the question of accepting or rejecting the Government's man-power proposals, was as follows:—In favour of accepting, 27,470; against, 121,017; majority against, 93,547.

The Labour correspondent of the *Daily Telegraph* states that the present membership is 275,000 approximately. Allowing for those on active service, in the Colonies, or under 18 years of age, the effective voting power is 215,000, of whom only 148,487 have voted. Therefore, 66,513 have not voted.

Board of Agriculture Electroculture Committee.—The announcement is made that the President of the Board of Agriculture and Fisheries has appointed a Committee to advise in regard to all electrical questions in connection with the carrying out of experiments in electroculture, and particularly in regard to the construction of apparatus suitable for use on an economic scale, and to the making of such electrical measurements as may be necessary in connection with the experiments.

The Committee is constituted as follows:—Sir John Snell, M.Inst.C.E. (chairman), Mr. A. B. Bruce, M.A., Prof. V. H. Blackman, F.R.S., Dr. Chree, F.R.S., Mr. W. R. Cooper, M.A., Dr. W. H. Eccles, M.I.E.E., Mr. J. S. Highfield, M.I.E.E., Prof. T. Mather, F.R.S., Dr. E. J. Russell, F.R.S., and Mr. C. T. R. Wilson, F.R.S.

Mr. B. W. Phillips, of the Board of Agriculture and Fisheries, will act as secretary to the Committee, and all communications should be addressed to him at 4, Whitehall Place, S.W. 1.

Revision of Charges under Existing Contracts.—Mr. H. Faraday Proctor has received a letter from the Ministry of Munitions with regard to the revision of charges under existing contracts for electricity supply, made necessary by the adoption of the 12½ per cent. award, stating that in general the business of electrical undertakings may be allocated to the following classes of consumers, viz.:—

1. Consumers with long-term contracts at pre-war rates, whose works are "controlled establishments."

2. Consumers with long-term contracts at pre-war rates, whose works are uncontrolled.

3. Consumers—both for power and light—supplied under contracts which are alterable by short notice.

With regard to the first class, the Minister is of opinion that a reasonable advance in price should be paid for energy supplied to controlled establishments, provided that the following conditions are observed, viz.:—

1. That so far as possible all classes of consumers shall be similarly dealt with; that is to say, that the burden shall be spread over all classes, although not necessarily by an addition of the same percentage advance in each case.

2. That the revenue resulting from an advance in prices shall, if more than sufficient to show the same return on capital as was earned during the financial year prior to the outbreak of war, after setting aside the same rate for depreciation or reserve, be dealt with in such manner as the Minister may decide.

3. That any advance in price under long-term contracts shall continue only during the period of Government control, unless the consumer otherwise agrees.

With regard to the second class of consumers, the Minister is of opinion that such consumers should voluntarily comply with the demand of the public service undertakings for a temporary advance in price on similar terms to those proposed in the case of the first class, and in this opinion the Board of Trade concur. Should difficulty be experienced in securing by consent an increase in price from uncontrolled establishments still paying pre-war rates for energy, procedure is open to suppliers under the Courts Emergency Powers Acts, but the Minister hopes that in very few cases would it be necessary to have recourse to this procedure.

With regard to the third class of consumers, the Minister understands that charges have been increased more or less generally, and that as a rule there is still a margin within the prescribed maximum prices which would permit of a further increase if necessary; but in the case of those undertakers whose Act or Order provides for a revision by the Board of Trade of the maximum prescribed, it is understood that the Board are prepared to consider applications on their merits.

Industrial Management.—A group of large firms engaged in the principal industries of the Manchester district has offered to the Governing Body of the School of Technology the sum of £3,000, spread over a period of five years, towards the cost of establishing a new department of industrial management. It is proposed that a lecturer should be appointed for this period of five years at a salary of £600, to conduct research in the subject of industrial management, to organise a new department, to lecture to members of the University and to the public, and to assist industrial concerns in the solution of management problems. A number of managers, directors, scientific experts, and others who have had special experience or are responsible for important innovations, will also be invited to deliver public lectures, being offered substantial fees which will not only pay them for placing their knowledge at the disposal of their fellow-managers, but serve to encourage enterprise and experiment in matters connected with management.

Appointments Vacant.—Charge Engineer (£196), for the Borough of Sunderland Electricity Department; charge engineer (70s.), for the Wakefield Corporation Electricity Department; station engineer (£3), for the Northern Command power stations; charge engineer (58s.); junior draughtsman for the Paisley Corporation Electricity Works; engineer (£225) for the L.C.C. Tramways Department. See our advertisement pages to-day.

The Cape Town City Council has been inviting applications for the position of assistant city electrical engineer, at £700 per annum.

Trade Marks.—The Trade Marks Committee of the Federation of British Industries has decided to oppose Part 2 of the proposed new Government Bill "To Amend the Trade Marks Act, 1905," on the ground that it will inflict serious injury on the owners of perfectly legitimate trade marks. Part 2 deals with "Provisions for the Prevention of Abuses of Trade Marks." It has also been decided by the same Committee that the proposed British Empire Trade Mark should be opposed.

Electric Lighting and Engine Starting Sets for Motor-Cars.—In connection with the discussion as to whether the operations of electric lighting and engine starting on petrol motor-cars should be carried out by separate machines or combined in a generator-motor, it is interesting to learn, as indicating the current practice in America, that out of 72 different makes of cars displayed at the recent Motor-Car Exhibition in New York, no fewer than 56 were fitted with the double-unit variety—that is, separate generators and motors—while on only 16 was the single-unit form adopted. In two cases the makers were apparently undecided, as on one model of car the one variety was adopted, while on a larger car the other form was installed.

Manganese Dioxide.—Practically inexhaustible deposits of manganese dioxide, which is extremely valuable as an iron-toughening material and in great demand for war munition purposes, have been found in the Cypress Hill, in South-East Alberta, Canada. Eight hundred thousand tons, worth approximately £11,000,000, have been blocked out by ordinary post-hole augers in the last few months.—*Science.*

Educational.—In a Report on the Education (No. 2) Bill, the British Science Guild expresses its cordial approval of the provision made in the Bill for the general development and organisation of all forms of education other than elementary; practical instruction for all elementary school children, provided that such teaching does not involve direct instruction for a trade; continuation schools, and compulsory attendance thereat for 320 hours per annum; the co-operation of Local Education Authorities by means of the formation of federations; abolition of exemption from attendance at school between the ages of five and fourteen; further restrictions as to the employment of children, and other features of the Bill. The Guild recommends that provision be made in the Bill for the inspection of all schools not now liable to inspection, and the adequate registration of all schools and other educational institutions.

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on January 25th, the presidential address was delivered by Prof. C. V. Boys, F.R.S. Referring to the Daylight Saving Act, he said that scientifically the thing was a sham, and as such was naturally distasteful to them; but the community at large was not scientific, and had a very vague notion of the meaning of time. In the stress of war the public had realised the desirability of starting the day earlier to save, not daylight, but paraffin and gas, and the simple operation of putting all the clocks wrong, though hateful in principle, did not disturb the public at all. With reference to the question of the metric system, this was important in relation to education. He believed the reason why English schools were so backward in mathematics was that so much of the available time had to be devoted to memorising tables of weights and measures and similar mediæval relics.

Another matter of public importance was the recognition of science as an element of general education. It was sometimes urged that our officials need not be scientific, because they could get all the scientific advice they wanted. But they might not know when they required it, or appreciate the force of it when they got it. He might instance in this connection the wasteful method of street darkening which still prevailed after three years. The annual trouble with frozen water pipes was another example of the general ignorance of scientific principles. Burst pipes were unknown in really cold countries, where the elements of common sense were allowed to prevail.

All his own contributions to physical science had been experimental, and some words on the art of experiment might not be out of place. In order to succeed as an experimentalist it was necessary to find by personal experience how as many materials as possible behaved under as many conditions as possible, and this could only be done by one who would practise every art and use every tool and instrument that he could. While endeavouring at first to imitate the practices of the professional mechanic and acquire as much of his skill as possible, the experimentalist must not be bound by tradition and custom in his methods. It was the slavery to tradition and practice that made the assistance of the professional so tiresome to the experimentalist. In this connection a saying of Fresnel had greatly impressed him—"If you cannot saw with a file and file with a saw you will be no use as an experimentalist," or words to that effect. He had made it his business to use every tool and to handle every material that he could.

At the annual general meeting, held on February 8th, the officers and Council for the ensuing session, as proposed on the balloting list, were unanimously elected. These included:—President, Prof. C. H. Lees, D.Sc., F.R.S.; vice-presidents, Prof. J. W. Nicholson, Prof. O. W. Richardson, Dr. S. W. J. Smith, Dr. W. E. Sumpner: secretaries, Dr. W. Eccles, City and Guilds Technical College, Leonard Street, E.C. 2; Dr. R. S. Willows; foreign secretary, Sir R. T. Glazebrook, C.B.; treasurer, W. R. Cooper, M.A., B.Sc.

The President announced that Dr. R. S. Willows was resigning his secretaryship, on leaving London, and the Council had appointed Dr. H. Stanley Allen in his place.

A paper on "A Recording Thermometer" was read by Prof. C. V. Boys.

Diesel Engine Users' Association.—The first meeting of the Association since the election of its new President, Mr. Napier Prentice, was held on January 31st. Further additions to the list of members and "subscribers" were announced. The Hon. Secretary reported recent communications with the Controller of Munitions Mineral Oil Production in connection with the subject of fuel oil supplies and the use of tar oil as fuel in Diesel engines. He further reported the appointment by the Controller of a Committee to assist him in these matters, especially in connection with applications for licences to use tar oil, and methods to adapt Diesel engines for the use of tar oil. This Committee is to be styled the Heavy Oil Engine Fuel Committee. It is composed of the nine members of the General Committee of the Diesel Engine Users' Association, to which have been added two further members nominated by the Institution of Electrical Engineers. The hon. secretary of the new Committee is Mr. Percy Still, M.I.E.E., and the offices are at 19, Cadogan Gardens, S.W. 3. Mr. John Milton read some notes giving the results of his experience in the use of tar oil as fuel in Willans-Diesel engines without pilot ignition apparatus.

Society of Engineers.—In his presidential address to the Society on Monday last, Mr. W. B. Esson referred to the fact that 60 years ago shipbuilding and engine building were great industries on the Thames. Ships of war, the finest ocean-going steamers, and the fastest sailing vessels were built on the Thames. Not a keel was laid on the Thames now. There was much business done in ship repairing, but shipbuilding had departed from the Thames, and with the launch of the super-Dreadnought *Thunderer* in 1911 the long history of shipbuilding on the Thames was closed. With the gradual disappearance of the wooden sailing ship and the development of the steel steamship, the shipbuilding yards in the South were no longer able to compete with those in the North, which were close to both iron and coal.

Institution of Electrical Engineers.—Among those present at the monthly meeting of the Scottish Local Section, when Prof. Magnus MacLean gave his Kelvin lecture, were Mr. Wordingham, the President, Mr. Rowell, the secretary, and Colonel Malcolm, of Poltalloch, whom the chairman (Mr. Arch. Page) described as the only surviving original member of the Institution. Colonel Malcolm explained that a brother officer of his, Colonel Webber, was in charge of some telegraph sappers in London, and made the acquaintance of Sir William Siemens; they discussed the advisability of forming some organisation, and he was invited by Colonel Webber to join it. The three began the work in a modest way, and were soon joined by others. He had not much directly to do with the founding of the Institution, being then at Chatham on military telegraph and military submarine work, but there was one thing which he did for them. There was a movement to get money, and it was proposed to turn this necessity into an opportunity for admitting female telegraph operators as members of the Institution. He strenuously opposed that, and saved the society, which was now one of the most important technical institutions in the world.

Mr. Wordingham said it was essential to progress that they should have co-operation among the various electrical bodies and institutions, and he knew of nothing which would tend to the promotion of such joint action so much as the establishment of an engineers' club. The Manchester club had exercised a great influence already, and he looked forward to the establishment in all important centres of similar clubs, by themselves or in conjunction with other industries. In many centres the necessity for such clubs was acutely felt. Speaking of the activities of the Institution, Mr. Wordingham acknowledged the valuable assistance lent by the Scottish members in the production of a series of rules for the Institution governing the equipment of ships, a proposition which was now nearing completion. He hoped that before the rules were published they would be brought in draft form before the Local Sections for discussion. Important research work was being carried out, and they had a number of active committees and sub-committees working in the closest possible touch with the B.E.A.M.A., while they were also taking part in the work of amending the Patent Law. They were also engaged in the movement for the establishment of an electrical clearing house for British manufactures, and had arranged for a joint meeting with doctors in connection with the application of electricity to medical treatment and healing.

Mr. C. P. Sparks has been appointed by the Council to be a member of the Committee of Management of the Benevolent Fund, in place of the late Mr. W. Duddell, and Mr. C. H. Wordingham, President, has been appointed representative of the Institution on the Governing Body of the Imperial College of Science and Technology, for the same reason.

The Committee of the Privy Council for Scientific and Industrial Research has made a supplementary grant of £87 10s. to the Institution for the Research on the Heating of Buried Cables.

With regard to the special general meeting held on November 29th, 1917, to consider the question of the expulsion of a member, when the matter was referred back, the Council finds that, under the Articles of Association, it is unable to take action upon the reference.

A private and informal meeting of members of the Institution will be held at the Institution of Civil Engineers, Westminster, on Thursday, February 28th, at 2.30 p.m., for the purpose of discussing the provisions of the Patents and Designs Bill.

Junior Institution of Engineers.—A meeting was held recently at Newcastle with a view to the formation of a Local Section of the Institution, and a resolution to that effect was carried. Mr. N. Thornton, 13, Nun's Moor Road, Fenham, Newcastle-on-Tyne, is the local hon. secretary.

Wages Award.—Among recent decisions given by the Committee on Production and the Special Arbitration Tribunal is the following:—British Insulated and Helsby Cables, Ltd.—Men of 21 and over, and paid as plain time workers, bonus of 12½ per cent.; pieceworkers and others on systems of payment by results, 7½ per cent.

Water Power in the U.S.A.—Recent important developments in Washington indicate that the Administration proposes to accomplish something definite in the development of the water power of the country. For several years past there have been independent programmes in the House and Senate covering the development of water power on the public domain and on navigable streams, but due to a lack of co-ordination of the several Governmental departments involved, nothing of consequence has resulted. Senate and House apparently have taken irreconcilable positions in the past. Both have passed measures, but neither has been able to agree with the other.

Hitherto the attempt has been made to pass separate measures pertaining to water power on navigable streams and on the public domain, but the present effort is directed towards a co-ordination of the interests of the three departments concerned.

The new Administration Bill provides for a Federal Power Commission, to be composed of three Cabinet officers—Secretary of the Interior, Secretary of Agriculture, and Secretary of War. It provides for an executive officer of the Commission, who shall be appointed by the President for a term of five years. It provides for the payment of rentals of not less than 10 cents per H.P. per annum, a feature to which there has never been objection of consequence by any interest. The Commission is empowered to grant licences to develop water power on public lands and navigable streams for a term of 50 years. At the end of the licence period the licensee upon application for a new licence shall remain in undisturbed possession until the proposed Commission shall have done one of three things: First, issue a new licence under laws at that time applicable; second, give a licence to a new licensee, who shall pay for the original fair value of the property; or, third, take the property over upon paying for its fair value. Fair value is defined to include actual cost of property taken plus severance damages for all property not taken over and damaged by reason of severance. Fair value does not include any allowance for enhancement of values on land or water rights granted by the United States, or goodwill, going value, or prospective revenues. The Bill provides for alteration, amendment, or repeal by Congress, which expressly reserves such rights, but in case of alteration, amendment, or repeal such shall not extend to the licensees who have exercised rights or spent money under the Bill.—*Met. and Chem. Engineering.*

Russian Water-Power Legislation.—A Petrograd journal says: The Ministry of Ways of Communication estimates the reserves of water power in Russia at 12,000,000 H.P. Various inquiries have increased this estimate to 20,000,000 H.P. Until recently in Russia only 1,000,000 H.P. were used, while for turbine installations less than a quarter of the total quantity of the local available water power was used. One of the chief reasons of the limited use of the water-power wealth of Russia is the lack of special legislation on the subject on the basis of which development might proceed. Besides this, the business of using the water power of the country has generally remained, says an official report, without a definite control. It has not been allotted to any one Ministry; hitherto the Imperial Duma has not paid attention to it, and no department hastened to appropriate it. In considering the estimates of the Department of Government Landed Property for the year 1913, the Imperial Duma showed the necessity of the earliest possible preparation of a project of law stating the legal regulations for granting water power to industries. The previous Chief Government of Land and Agriculture then began the preparation of a plan with the intention of keeping the business in that department. But the Minister of Ways of Communication, in his turn, submitted a detailed *projet de loi* to the Council of Ministers subjecting the business of the use of the water power to this Ministry. The leading principle of the Government regulation showed, however, according to the general and governing acceptance of this law, that only those watercourses were to be subjected to the Government control which, by special Government decrees, were proclaimed as of Government and of communal importance. The Ministry of Land, on the contrary, considered it necessary to extend the operations of the law to all watercourses of over 300 H.P. Subsequently the Ministry of Trade became interested in the problem of white coal in connection with the bearing of the acute fuel crisis upon industry. It was considered that in view of the importance which hydro-electric installations acquired for industry, the Ministry of Trade should assume the rôle of proprietor in the business. One cannot estimate how much time might have been spent in the struggles of the different departments on the various projects, if the revolution had not cut this Gordian knot along with others. The general moral upheaval and the general accession of fresh social strength played a useful part here, for by agreement of the three interested Ministries a provisional law on the use of water power was prepared and carried through the Provisional Government in the course of two or three weeks. Such a rapid decision on the question was due to two circumstances. The whole matter was handed over to the newly-formed extra-departmental Committee for the Use of Water Power, and in place of the exhaustive and cumbrous projects of the Ministries of Ways of Communication and Land, it was decided to limit them to basic principles on condition that the further regulation of the question should be carried through by the Committee itself. The importance of the law lies in the recognition of the Government's right to dispose of all the water power units of the country, in so far as such may be exploited by means of hydro-mechanical installations. (Paragraph 1 says:—"Only on the basis of concessions and permits granted by the Government.") The law does not limit the extent of such installations; and for their construction it is necessary to obtain a concession from the Government. Such a limitation is one of the delicate points of the whole problem of white coal use; as it is difficult, or even generally impossible, to find a criterion that would be sufficiently elastic whilst adequately dealing with the problem of definition. The law, therefore, charges the Committee with the limitation of the various installations and the fixing of the most accurate possible conditions for their existence, and requires it to prepare and submit suitable regulations for the approval of the Provisional Government. Until the confirmation of these rules the basic principle of each concession is subject to legal review. The alienation of river-course lands and their modification for the construction of installations and of lines for the transmission of electrical power is more fully regulated by the law. The law allows compulsory alienation for all installations of not less than 300 H.P., as well as for installations of less power which by special order of the Committee are recognised as of Government or communal importance. On the very difficult question of compensation for compulsory alienation of lands or properties, the law, however, lays down complete regulations. Another novelty is found in the categorical refusal to the riparian proprietors of compensation for such profits from the alienated watercourses as are not being used by them at the moment of alienation. In other words, the value of the water power, as such, will be compensated for to the owner of the water wheel or turbine, but not to the riparian owner who has not yet used his watercourse, although it may have been specially acquired by him for the use of the water power. The last paragraphs of the law are devoted to the organisation and definition of the function of the Committee on Water Power.

B. of T. Tramways Committee.—At a conference of tramway authorities in Newcastle-on-Tyne, the Board of Trade representatives mentioned that the tramway resources of the country were for the present national purposes to be regarded as pooled, and available for all the undertakings when necessary.

It is recommended that Mr. Hume, Mr. A. H. Scott, and Mr. J. H. Bruce shall represent the L.C.C. Tramways at the conference of undertakings to be held in London on the 27th inst. in connection with the appointment of local Advisory Committees to assist the B. of T. Tramways Committee.

Summer Time.—This year "Summer Time" is to begin on Sunday, March 24th, and continue until Sunday, September 29th.

A Light Detector for the Blind.—M. F. Hames, writing in *L'Industrie Electrique*, makes the following suggestions for a light detector which might do something to alleviate the terrible plight of the many hundreds totally blinded during the war. The detector itself would comprise a thermo-couple (such as is used in one type of Féry pyrometer) placed at the focus of a lens or parabolic reflector. Two such detectors could be mounted to form a pair of spectacles. The receiver would be a special type of telephone receiver, consisting of a coil through which passes current from the thermo-couples, and a soft iron diaphragm traversed by intermittent current from a small Ruhmkorff coil. When light falls upon the thermo-couples in the eye-pieces, the bobbin in the receiver produces a magnetic field, and interaction between the latter and the intermittent current in the diaphragm causes the iron plate to vibrate. The intensity of the note emitted should make it easy to determine the direction of the sun or of a lamp or window, and to "see" whether a lamp is alight, and so forth. Experience in the manufacture of such instruments would doubtless lead to improvements, and it is quite likely that they would prove more useful to a blind person than can be conceived by anyone who has not been deprived of his sight. The receiver could be held to one ear by the spectacle frame, and the Ruhmkorff coil and dry cell or accumulator could be carried at the waist or in the pocket. It would be an act of mercy to investigate and develop to the utmost the practical possibilities of this suggestion. We may point out that it is not at all necessary that the detector should be carried on the face.

Calorised Iron for Thermo-couples.—O. L. Kowalke, in the *Proceedings* of the American Electrochemical Society, states that there are available several thermo-couples with iron as one of the elements which have high electromotive forces and are fairly constant, but have the disadvantage that the iron element oxidises rapidly above 500° C. If iron could be protected from oxidation by some sort of coating which would not greatly change the electromotive force, its usefulness as an element for thermo-couples would be greatly extended. It has been shown by W. E. Rudder that "calorising" iron, which consists in producing a rich aluminium alloy upon the surface of the metal, practically prevents oxidisation below 1,000° C. The author has compared the thermo-E.M.F.'s of couples of calorised iron-constantan with that of uncalorised iron-constantan, and finds that they are identical up to 1,000° C.; he concludes that a heavy wire, lightly calorised, gives as constant results as uncalorised iron and has a much longer life. —*Journal* of the Franklin Institute.

A Large American Electric Steel Furnace.—The largest electric furnace in the United States is at work in the steel department of the Carnegie Steel Co., at Duquesne. It is of the Héroult type, and has a capacity of 20 tons, but has made as much as 25 to 30 tons. It began work in November, 1916, and requires 175 KW.-hours per ton of steel, operating basic on hot metal. There are three electrodes of 12-in. graphite, and the electrode consumption is now from 3 to 4 lb. per ton of steel. The current is three-phase, received at 6,600 volts, and is transformed to 100 volts at the furnace. Six heats are made per day of 24 hours, and each heat averages about 2½ hours. The steel produced by the furnace is used principally for small gun forgings, ball races, and steel balls. —*Iron and Coal Trades Review*

Useless Railway Work.—According to the New York correspondent of the *Times*, a statement made by Mr. Henry Ford occupies the foreground of the discussion of the railway problem. He makes the following criticism of the railway service:—The freight car weighs as much as the load it generally carries. It travels two-thirds full and comes back empty. Passenger trains weigh 50 to 150 times as much as the passengers in them. A Pullman car weighing 30 to 40 tons averages less than a ton of passenger load. Four-fifths of the work of a railway to-day is hauling the dead-weight of its own wastefully heavy engines and coaches. This is why railway presidents have such a hard time to figure out freight and passenger rates high enough on 20 per cent. of the live load to cover the cost of hauling this enormous 80 per cent. of dead-weight around. Nature has distributed alloy materials which, with heat treatment, make steel of 75 or 100 tons tensile strength instead of 25 tons. And then the weight can be cut down proportionately. Alloy steels of high tensile strength cut down the weight of truck and automobile.

This criticism applies also to electrical vehicles of all kinds, and calls attention to a matter of great importance.

Time Signals between the Eiffel Tower and Switzerland.—On the outbreak of war the Swiss Federal Government seized the apparatus at all wireless stations, so that these stations could no longer receive the daily time signals from the Eiffel Tower. At the urgent request of several establishments which have no longer the means at their disposal for checking the time, the Swiss Telegraph and Telephone Administration decided to arrange for the re-transmission, by telephone, of the radio-telegraphic signals given by the Paris Observatory. Since August, 1916, Swiss telephone subscribers have thus been able to receive, by telephone, each day between 10.56 and 11 a.m., the Eiffel Tower signals transmitted to Berne and repeated simultaneously. A recent communication by Monsieur Paul Ditisheim to the Swiss Geophysical Society states that this service has worked perfectly, and that the signals transmitted vary not more than ± 0·087 second from the time as transmitted from Paris.

Electric Precipitation of Solids.—Since hot smelter smoke rises higher and diffuses so much more readily than colder smoke, the Cottrell process is supplanting the baghouse for clarifying the gases from solids. Baghouse operation depends upon relatively low temperatures, 200° F., or thereabouts. Hence in general a great deal of heat must be taken out of the roaster gases if they are to be sent more or less directly through the bag-house, and loss of heat means that the height to which such cooled gases will rise will be proportionate to the amount of heat remaining in them. The Cottrell process of clearance permits much higher gas temperatures, thus supplanting the baghouse.—*Met. and Chem. Engineering.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. V. Bradshaw, of Wigan, has been appointed to the position of chief assistant electrical engineer to a national filling factory.

Mr. L. Woodman, electrical engineer to the Dover Corporation, and Mr. E. Carden, manager of the tramways, have resigned their appointments.

The Buxton T.C. has increased the salary of the acting electrical engineer to £215 a year, rent and rates.

Company-Sergeant-Major H. P. Baynham, formerly superintendent at the Carlisle municipal electricity works, who joined the Royal Submarine Mining Corps in March, 1915, has been granted a commission.

The Faversham T.C. has increased the salary of the electrical engineer, Mr. G. Sommerville, from £200 to £250 a year as from October last, making his total emolument £280.

Londonderry Electricity Committee has increased the salary of Mr. R. V. Macrory, electrical engineer, by £200 per annum, making it £600, on account of increased work and responsibility.

Mr. J. A. Robertson, borough electrical engineer of Salford, has received information that his son, Second-Lieutenant C. A. Robertson, who was reported missing on November 30th last, is a prisoner of war in Germany, and slightly wounded.

The Salford Corporation has decided to increase the salary of Mr. J. A. Robertson, borough electrical engineer, by three annual advances of £100, £100, and £50 respectively to a maximum of £1,250, the first advance to commence as from April 1st, 1917. The Corporation has also adopted a scale of salaries under which the maximum salaries of the staff will be increased as follows: Deputy engineer, from £340 to a maximum of £500 per annum; mains engineer, from £300 to £375; station superintendent, £250 to £375; charge engineers, £200 to £250.

General.—Mr. J. H. Sandiford has resigned his position in the switchgear department of Messrs. Ferranti, Ltd., Hollinwood, in order to take up an appointment with Messrs. Ferguson, Pailin & Co., Ltd., as their engineer and representative for the London district. A presentation of an electro-plated tea set was made by Mr. J. Denham, the manager of the department, on behalf of the staff.

Dr. H. E. J. G. du Bois, of the Berlin University, has lately received an appointment from the Dutch Government as Principal of a new Electricity and Magnetism Department at the University of Utrecht.

Roll of Honour.—Private S. Hay, of the Essex Regiment (Territorials), was killed in action in Palestine. He was formerly employed at the Bognor electricity works.

S. Stocks, E.R.A., of H.M. Navy, who is reported missing, aged 31, was employed at Accrington Corporation electricity works.

Private A. Weaver, Cheshire Regiment, killed in action, aged 26, was employed by B.I. & Helsby Cables, Ltd., Helsby.

A.B. William Agnew, who was in the employ of the British Westinghouse Co., Ltd., Trafford Park, and previously an electrician in the service of the White Star Line, is officially reported drowned at sea on January 31st. He was 27 years of age.

Sapper T. Maudsley, R.E., who was prior to the war electrician to Major Fermor-Hesketh, of Rufford Hall, is reported killed.

Lance-Corporal H. Booker, Royal Fusiliers, who has fallen in action, enlisted from the works of the Telegraph Construction & Maintenance Co., East Greenwich.

Mr. F. J. Salter, who has died after being invalided from the A.S.C., was prior to the war engaged at the L.C.C. generating station at East Greenwich.

Private C. Broadbent, who had died of wounds, was an electrical engineer, and belonged to Douglas (Isle of Man).

Wireless Operator E. Hollamby lost his life by the sinking of H.M.S. *Raglan*.

Gunner G. Spooner, R.F.A., who was engaged with Messrs. Bullers, Ltd., of Hanley, is reported missing.

Will.—The late Mr. J. C. Merryweather (Merryweather and Son, Greenwich) left £135,975 gross and £131,980 net personalty.

NEW COMPANIES REGISTERED.

Tees Power Station Co., Ltd. (149,607).—Registered February 13th. Capital, £700,000 in £1 shares. To acquire from the Newcastle-upon-Tyne Electric Supply Co., Ltd., a piece of freehold land at Billingham, Durham, to erect thereon a generating station for electrical energy, to erect any similar stations elsewhere, to enter into an agreement with the said Newcastle Co., or any of its associated companies, for operating the said station or stations, to utilise and sell gases, waste heat, and other products, to supply electrical energy, to construct, lay down, establish, and fix cables, wires, lines, accumulators, motors, lamps, and works, to carry on the business of electricians, mechanical engineers, &c. The subscribers (each with one share) are:—J. S. Watson, Royal Exchange Buildings, Newcastle-on-Tyne, engineer; H. A. Bowes, Royal Exchange Buildings, Newcastle-on-Tyne, engineer; R. Harrison, Royal Exchange Buildings, Newcastle-on-Tyne, clerk; H. E. Nelson, 1, Maritime Terrace, Sunderland, clerk; T. Chrisp, 8, Kensington Gardens, Monkseaton, clerk; G. N. Nicholson, Royal Exchange Buildings, Newcastle-on-Tyne, accountant; E. S. Patterson, 11, Sydenham Terrace, Whitley Bay, cashier. Minimum cash subscription, seven shares. The first directors are:—J. H. Armstrong and R. P. Sloan. Qualification, £100. Directors must be British subjects. Remuneration as fixed by the company. The articles contain various clauses prohibiting foreign control. Registered office: Royal Exchange Buildings, Newcastle-on-Tyne.

White Electrical Instrument Co., Ltd. (149,605).—Private company. Registered February 12th. Capital, £10,000 in £1 shares. To take over the business of an electrical and scientific instrument manufacturer carried on by Kate I. B. White, at 2-6, Gloucester Street, Clerkenwell, as the White Electrical Instrument Co. The subscribers (each with one share) are:—Mrs. Kate I. B. White, Woolacombe, Wood Street, High Barnet; C. E. Cox, 108, Wellington Road, Bush Hill Park, N., manager; T. J. Nance, 19, Petworth Street, Battersea, S.W., secretary; W. Maskell, 7, John Street, Bedford Row, W.C., solicitor. The first directors are:—Mrs. Kate I. B. White and C. E. Cox (managing director). Qualification, £100. Registered office: 2-4, Gloucester Street, Clerkenwell, E.C.

E. G. S. Co., Ltd. (149,613).—Private company. Registered February 13th. Capital, £20,000 in £1 shares (10,000 6 per cent. cum. pref.). Electricians, electrical and mechanical engineers, manufacturers of accessories and appliances for ships and vessels, oil merchants, drysalters, manufacturers of and dealers in chemical preparations, motor vehicle manufacturers and dealers, &c. The subscribers (each with one share) are:—Major J. L. Marr, Russell Hotel, London; W. B. Marr, Glenville, Roker, Sunderland, electrical engineer; J. Dodds, Winifred House, Cleadon, *viâ* Sunderland, electrical stores merchant. The first directors are:—Major J. L. Marr, W. B. Marr, J. Dodds (managing director), and J. Marr. Qualification, £100. Registered office: Pudding Chare, Newcastle-on-Tyne.

Medical Supply Association, Ltd. (149,598).—Private company. Registered February 12th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in surgical instruments, medical appliances, X-ray and electromedical apparatus, orthopædic, anatomical and dental appliances, boots, stays, artificial eyes and limbs, bandages, crutches, chairs, stretchers, ambulances, chemicals, drugs, and hospital requisites, &c. The subscribers (each with [illegible] shares) are:—Mrs. S. Greville, 21, The Avenue, Kew Gardens, S.W.; Ernest E. T. B. Greville, 21, The Avenue, Kew Gardens, S.W., M.D., surgical instrument maker. The first directors are:—E. T. B. Greville, Mrs. S. Greville (permanent), Captain E. R. G. Greville, R.A.M.C., and Mrs. E. Howes. Registered office: 167-185, Gray's Inn Road, W.C.

Metallic Electrical Engineering Co., Ltd. (149,515).—Private company. Registered February 2nd. Capital, £15,000 in £1 shares. To take over the business of tube factors and electrical engineers carried on by the Metallic Seamless Tube Co., Ltd., at Corporation Street, Birmingham, and elsewhere, as a branch of their general business of tube makers. The subscribers (each with one share) are:—G. Y. Iliffe, Hazelhurst, Russell Road, Moore Green, Birmingham, manufacturer; A. E. Beck, High House, King's Norton, Worcs., engineer. The first directors are:—G. Y. Iliffe, A. E. Beck, G. O'Connor Holloway, F. W. Bevins, and W. H. Bowater (permanent). The Metallic Seamless Tube Co., Ltd., may, while holding three-fourths of the paid-up capital, appoint directors. Solicitor: T. W. Horton, 4, Bennett's Hill, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harrow Electric Light & Power Co., Ltd.—Memorandum of satisfaction in full on June 1st, 1917, of mortgage dated December 31st, 1900, securing £1,525, has been filed.

A. Vernon Ward (Manchester), Ltd.—Memorandum of satisfaction in full between June 16th, 1917, and January 25th, 1918, of debentures dated February 6th, 1917, securing £500, has been filed.

Electrical Contracts & Maintenance Co., Ltd.—Memorandum of satisfaction in full on December 19th, 1917, of debentures dated December 5th, 1916, securing £1,000, has been filed.

British Electrolytic Zinc Co. (Isherwood Process), Ltd.—Issue on September 17th, 1917, of £3,800 debentures, part of a series of which particulars have already been filed.

Costa Rica Electric Light & Traction Co., Ltd. (56,447).—Capital, £130,000 in £1 shares Return dated January 11th, 1918. All shares issued, £7 paid, £129,993 considered as paid. Mortgages and charges. £286,650.

City of Freetown (Sierra Leone) Electricity Co., Ltd. (138,058).—Capital, £15,000 in £5 shares. Return dated December 31st, 1917. 200 shares taken up, £1,000 paid. Mortgages and charges: Nil.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in 220,000 pref. and 205,000 ord. shares of £1 each. 214,195 pref. and 150,548 ord. taken up to December 25th, 1917; £52,839 paid on 24,999 pref. and 27,840 ord.; £311,904 considered as paid on 189,196 pref. and 122,708 ord. Mortgages and charges: Nil.

Bastian Electric Co., Ltd.—Issue on February 4th, 1918, of £200 debentures, part of a series of which particulars have already been filed

CITY NOTES.

London Underground Electric Railways.

London Electric Railway Co. The aggregate gross traffic receipts of the five companies parties to the Common Fund Agreement (City & South London, Central London, London Electric, Metropolitan District, and the L.G.O. Companies) were £5,843,201. The aggregate gross receipts of the five companies from all sources were £6,661,863. The aggregate amount retained by the five companies for revenue liabilities was £6,141,526. The balance of £520,337 was credited to the Common Fund. This company is entitled to £156,101 (30 per cent.), to which is added £24,474 brought forward. Dividend for the year on the ordinary shares, 1½ per cent.; £45,000 to reserve; carry-forward, £30,656. Capital expenditure during the year, £9,348.

Metropolitan District Railway Co. This company is entitled to £62,440 (12 per cent.) of the balance of £520,337, and £20,688 brought forward is added. Dividend on the second preference stock, 3 per cent.; £45,000 to reserve; carry-forward, £29,029. Capital expenditure during the year, £2,828.

Central London Railway Co.—This company is entitled to £104,067 (20 per cent.) of the balance mentioned, and £12,079 brought forward is added. Dividends: 3½ per cent. on the ordinary and 4 per cent. on the preferred ordinary stock, leaving £11,147 to carry forward. Capital expenditure during the year, £47,746. The construction of the extension railway between Wood Lane and Ealing Broadway cannot be further proceeded with at present owing to the war. The conveyance of parcels by train and delivery by cycle messenger service from the stations has been discontinued during the year.

City & South London Railway Co.—This company is entitled to 6 per cent. of the Common Fund (£31,220), to which is added £17,245 brought forward. Dividend on consolidated ordinary stock, 1½ per cent. for the year; £25,000 to reserve; £21,266 to carry forward. Capital expenditure during the year, £11,142.

Yorkshire Electric Power Co.

The net profit for 1917, after payment of mortgage and other interest, was £33,258, against £29,112 for 1916, and £21,209 for 1915. Adding £3,866 brought forward, £37,124 is available. After paying 6 per cent. on the preference shares, 5 per cent. on the ordinary, as against 3 per cent. last year, and putting £12,000 to general reserve, £4,391 is to be carried forward. The company continues to make substantial progress. During the year there have again been material increases in the cost of labour and supplies. In November last a 6,000-KW. turbo-alternator was put on load, and an additional machine of the same output has been ordered, and is now being erected. To meet the cost thereof, and of considerable extensions to the company's plant and mains in the southern portion of the area of supply, the Ministry of Munitions have agreed, in addition to the £60,000 mentioned in the last annual report, to lend to the company further amounts not exceeding £122,000 which will be secured on the plant and mains so erected. The demands for electrical energy have been heavy during the year, and large developments in various parts of the company's area are being made which will call for further supply from the company's mains. To enable these developments to be dealt with, the directors have secured a site at Ferrybridge, near Knottingley, on which to erect a generating station with large units of plant. Of the £71,640 of 6 per cent. cum. pref. shares authorised in September, 1916, £18,750 is still available. 98 members of the staff have joined the Forces, and eight have laid down their lives.

At the annual meeting of the company, held on Tuesday, the Chairman, after stating that the year's progress was satisfactory, showing an increase of revenue at the rate of 25 per cent., reviewed the progress made during the last 12 years. Year by year the rate of progress had accelerated, indicating a fuller appreciation of their service by old customers, and a greater readiness to make use of it on the part of others. It was reasonable to anticipate that future progress would be much more rapid. The powers of the company under their Act were twofold; first, to supply in bulk to districts in which electric distribution powers had been granted to local authorities and others, and secondly, to supply power in districts where there were no authorised distributors. Unfortunately, under their Act they were not empowered to supply current for lighting except in connection with power. The allied company—Electrical Distribution of Yorkshire, Ltd.—had therefore undertaken this duty, and with the approval of the local authorities concerned held lighting orders in 24 areas, with a population of 330,000, which otherwise would be without this necessity of modern existence. Their business was increasing, though some of their Orders were held up owing to the war. Experience had shown that a multiplicity of distributing authorities did not make for economy; as a consequence, 14 local authorities in their area who had obtained supply powers allowed them to lapse, eight others transferred them to Electrical Distribution of Yorkshire, Ltd., and, in addition, seven local authorities and one company were taking a bulk supply from the Power Co. Bulk supply was steadily growing, though it had not developed so rapidly as the power supply business, in which the company dealt with the user direct. At present their mains were fed from three stations, at two of which the generating plant was now being extended, and would continue to be so as need arose, but they had to look to the future and the much larger demands that were before them. The future cost of electricity supply depended on generation on a large scale on sites chosen so that the fullest benefit could be obtained from the use of large generating units. Such power stations as would be needed for the future should, on the score of health and on account of the value of land, be situated outside the large towns and in proximity to the coalfields, and they must, to obtain the full efficiency of the modern steam turbine, be adjacent to an ample supply of water. The West Riding was well supplied with streams, though, individually, on a rather small scale compared to the requirements of modern central generating stations, so that the directors had felt it necessary to look ahead. They had arranged to acquire a site and erect a station at Ferrybridge, where the water supply and the proximity to the coalfields would enable large generating units to be installed and worked under the most economical conditions. During the war they had been called upon to supply power to various munition works, and had been able to give them valuable assistance in the saving of time as well as money. Owing to their supply, the country had made a clear saving during the year of the consumption of some 50,000 tons of coal, and of the extra smoke and dirt which would have been spread over the country and fouled the atmosphere. The treatment of coal so as to extract its valuable chemical constituents, as well as to use it for power purposes, was a problem which was engaging the attention of the Government, the coal and chemical trades, and others, and in this new development the company was actively assisting. The problem was such an important one that all the interests involved should work together, each taking its part, and the company looked for a further development of the co-operation with colliery owners, of which an instance was found in the utilisation of coke-oven gas at the company's Barugh power station. The company's area of supply included the great Yorkshire coalfield with an annual output of some 40 million tons, and in which some 400 mines were being worked. Practically the whole of these mines were outside the large towns, and the company's system was the obvious means of conveying power generated in the coalfields to the various industrial areas. The collieries themselves were already important users of the company's supply to the extent of over one-third of the total output, and the growing appreciation of the advantages of co-operation between collieries and the company should lead to a large increase of this business. Great developments were also taking place in the iron and steel industries, and preparations were being made for the time when peace might be restored. These developments would provide a demand for every unit of electricity that they could generate, and their company must be prepared to take its part with a full hand when the time came. Referring to the report of the Coal Conservation Sub-Committee of the Ministry of Reconstruction, a commission, the Board of Trade Electric Power Supply Committee, was now sitting to consider how the desired results could be best attained. It was impossible to say what form their report would take, but there was no doubt that the national waste inseparable from small separate installations must be obviated. He had every confidence that the work in this direction which had been done by this company would meet with recognition. One solution of the problem would be co-operation between the installations of the large municipalities in their area and this company, the smaller stations being gradually closed down, and taking their supplies from a few large installations which should be worked on the most scientific basis for economy of coal consumption and the reclamation of by-products

They had tried to obtain co-operation in this direction, and would welcome it; if the electrical installations could not arrange it amongst themselves, he believed it would be forced upon them. Already they were working in concert with the city of Bradford, and they hoped to greatly extend that agreement to their mutual advantage, and they were endeavouring to enter into similar working arrangements with other cities. These new departures would call for very large extensions on the part of their company, but when the time came he felt confident that he might count on the support of the shareholders. Plans and estimates for the Ferrybridge station were being prepared, and when they were ready they would be asked to sanction the further issue of capital. The scheme was a big one. When it came before them he would ask them to remember that they had now established their business on a large scale, that they had a growing revenue, and that with increase of output would come relative reduction in the cost of generation and of standing establishment costs. When the war came to an end the country would have before it the task of reconstructing its industries to obtain the greatest possible output for labour, and for this there was nothing more important than a supply of power, which would render every man's labour more efficient, and enable wages paid to be based on output, as in America, where so much greater use was made of horse-power per head than in this country, and where they had recognised that it was the output per head that enabled higher wages to be paid than they had been accustomed to in this country.

Electrical Distribution of Yorkshire, Ltd.—Net profit for 1917 £3,693, against £3,495 in 1916 and £3,638 in 1915. Including £730 brought forward, the disposable balance is £4,423, out of which 6 per cent. dividend (free of tax) is paid on the ordinary shares, and £696 is carried forward subject to directors' remuneration. Under war conditions the results are satisfactory. Parliament has confirmed the granting of provisional orders for Featherstone, Garforth, Horbury, Otley, Penistone, and Rawdon, but they will not come into force until after the termination of the war. In order to provide for the development after the war of the districts for which Orders have been obtained, and to make extensions in those districts in which supply is now being given, the directors recommend the increasing of the nominal capital from £50,000 to £100,000.

Lancashire United Tramways, Ltd.—The result of working of the combined undertaking shows traffic receipts £124,825, electrical energy sold and miscellaneous receipts £16,389, making £141,214; less working expenses, £70,093; cost of generating energy sold, £10,480; general charges (including direction, management, &c.), £5,977; rent of leased lines, £5,191; leaving £49,473, which added to dividend on holding in the New St. Helens & District Tramways Co. £3,068, makes a combined profit of £52,541. The receipts, compared with the previous year, show an increase of £32,942. The traffic earnings per car mile amounted to 14.73d. The increase in expenditure amounted to £13,506, which was principally due to increases in wages under arbitration awards and to the high price of materials. To meet these increased charges the directors in September last raised the fares on the system. Agreements have been entered into with the Lancashire Electric Power Co. and the Leigh Corporation, whereby the three electrical systems are linked up for the purposes of reciprocal supply. The interest and dividends received by the company from the operating companies, together with sundry receipts, amounted to £21,985. After deducting interest in the prior lien debenture stock, income-tax and expenses, there remains a balance, out of which the full interest of 5 per cent., less tax, will be paid on the second mortgage debenture stock for 1917, £68 being carried to depreciation account.—*Financial Times.*

Electro-Bleach & By-Products, Ltd.—Further interim dividends on account of the year 1917 of 3½ per cent., less tax, on the preference shares (making 7 per cent. with the interim dividend paid in September last), and of 10 per cent., less tax, on the ordinary shares. The negotiations between the company and the Government in regard to the duties payable under the Finance Acts and the Munitions of War Acts have made considerable progress, and the directors hope that there will not be much further delay before they are in a position to issue the balance sheets for 1916 and 1917. The directors are again satisfied with the progress made, but do not think it likely that they will recommend the payment of further dividends on account of the two years in question.

Smithfield Markets Electric Supply Co., Ltd.—The gross profit for 1917 was £2,268, against £3,797 for 1916, and the net profit was £1,101, compared with £2,167. £500 has been written off "alteration of pressure" account, and £400 placed to debenture stock redemption fund. The balance remaining, including £1,013 brought forward, is £1,214, which is to be carried forward. Mr. G. E. Leon has been appointed an additional director.

British Insulated & Helsby Cables, Ltd.—The directors have decided, subject to the sanction of the Treasury being obtained, to recommend to the shareholders that the company's capital should be increased to such an extent as to enable the issue to be made to the shareholders of one fully-paid ordinary share for each ordinary share held by them.—*Times.*

Llandudno & Colwyn Bay Electric Railway Co., Ltd.—Profit balance £4,874, including £157 brought forward; £1,695 is put to sinking fund instalment; dividend 3 per cent.; carrying forward £197.

National Electric Supply Co., Ltd.—Gross profits £13,825; to reserve for depreciation on machinery, &c., £5,000. Dividend 3s. 6d. per share, making 6s. for the year, carrying forward £160.

National Boiler & General Insurance Co.—In addition to the interim dividend of 12s. per share, the directors recommend a dividend of 13s. per share, less tax, putting to investment reserve £6,748, and carrying forward £1,393.

Globe Telegraph & Trust Co., Ltd.—Interim dividend, 2s. per share, free of tax, on ordinary shares for quarter.

Fife Tramway, Light & Power Co.—Profits for the year, £31,278. Dividend on the ordinary shares at 5½ per cent. per annum, less tax; to reserve, £10,000; carry forward, £8,390. The construction of the tramways from Dunfermline to Rosyth was commenced in September last, at the request of the Lords Commissioners of the Admiralty, and they will be ready for service in a few weeks. It will be necessary in the near future to make an issue of debenture stock to meet the balance of the cost of the construction of the Rosyth tramways, and to provide for the further plant required by the growth of the company's undertakings.

Mather & Platt, Ltd.—The net profits, after charging depreciation, and making provision for doubtful debts and losses in exchange, amounted to £168,487. There has been transferred to income-tax equalisation £35,000, leaving £133,487, plus £86,514 brought forward, less £5,000 to employés' benefit fund. The directors recommend a dividend for the last half-year of 12½ per cent. on the ordinary shares, making 17½ per cent. for the year, less tax, carrying forward £95,001. The large carry-forward is arranged in view of demobilisation and reconstruction after the war. The company's assets in Russia have been written down to the present nominal rate of exchange.

Traction & Power Securities Co.—Net revenue £28,499. A dividend of 6s. 6d. per share, free of tax, absorbs £27,758, leaving £9,908 to be carried forward. The investment in the Mersey Railway Co. debenture stock remains unchanged. The position of the Clyde Valley Electrical Power Co. has further improved. Dividends aggregating 2½ per cent., free of tax, were paid on its ordinary shares. The company has realised its holding of Clyde Valley preference shares and a small part of its ordinary shares, along with certain other holdings, and has advanced £80,000 to the Clyde Valley Electrical Power Co. on loan.

Mersey Railway Co.—The report for 1917 states that the total amount available for payment of interest is £48,249, which has been applied to payment of interest at 4 per cent. on the 1866 debenture stock, 3 per cent. on the 1871, 1882/3/5 debenture stocks, and 1 per cent. on the "B" debenture stock, leaving £195 to be carried forward.

Llanelly and District Electric Lighting & Traction Co., Ltd.—Available profit, including £1,483 brought forward, £15,185. After providing for debenture interest and redemption, writing £1,100 off machinery, putting £3,000 to reserve and renewals, and paying the preference interest, 4 per cent., less tax, is to be paid on the ordinary shares, and £1,331 carried forward.

Westminster Electric Supply Corporation, Ltd.—Total connections increased during 1917 from 43,969 KW. to 48,084 KW. After allowing for depreciation, sinking fund, and other charges, and the 4½ per cent. preference dividend, 9 per cent. for the year on the ordinary shares is paid, leaving £13,267 to carry forward. Units sold, 27,813,326, including A.C. supply of 1,392,805; used on works 284,632 units; total, 28,097,958.

City & South London Railway Co.—At the annual meeting, Lord Stuart of Wortley said that had it not been for the war the railway would have been reconstructed and a standard type of tube trains, with modernised carriages, would have been introduced. At present nothing could be done. The system was the pioneer of tube railways, and its rolling stock and equipment should now be renewed completely.

Bruce Peebles & Co., Ltd.—A petition has been presented at the instance of the company asking the Lords of Council and Session to order meetings of members and debenture holders to be held for the purpose of considering and approving a scheme of arrangement specified in the petition.

Cambridge Electric Supply Co., Ltd.—The total profit for 1917 was £8,072, plus £2,606 brought forward. After deducting debenture and other interest £1,772, and placing £1,500 to depreciation fund, a dividend of 5 per cent. is paid for the year, carrying forward £2,947.

Liverpool Overhead Railway Co.—Dividend on the ordinary shares 3½ per cent. for 1917, carrying forward £6,929. Passengers carried 16,699,537—a slight decrease. Gross revenue, £120,570; working expenses, £89,806.

France.—La Société des Tréfileries et Laminoirs du Havre is increasing its capital from £1,000,000 to £1,500,000

South Metropolitan Electric Light & Power Co., Ltd.—The revenue account for 1917 shows a credit balance of £55,163, plus £7,219 brought forward, and £1,002 dividend of 10 per cent. on the company's holding in the West Kent Electric Co., Ltd. After paying debenture interest less interest received, 7 per cent. on the first preference shares, and 6 per cent. on the second preference, £18,650 is put to depreciation fund, and 6 per cent., less tax, is to be paid on the ordinary shares, £7,626 being carried forward. The number of consumers increased from 6,985 to 7,111; H.P. connected rose from 21,411 to 23,905 H.P.; gross revenue advanced from £95,883 to £131,930; expenditure from £45,373 to £76,767; net revenue from £50,510 to £55,163. A further substantial improvement is shown in gross revenue, but the expenditure has been largely increased by the high price and unreliable quality of coal, while freights have been exceedingly high. The second 5,000-KW. turbo-alternator was put to work last August. The revenue of the West Kent Co. has increased from £27,677 to £45,139, and the net revenue from £5,432 to £7,012. Mr. H. B. Renwick has been appointed a director.

St. James's & Pall Mall Electric Light Co., Ltd.—During 1917 the connections increased from 16,631 KW. to 17,253, and 11,986,051 units were supplied to consumers. (The Central Electric Supply Co. has determined to pay no dividend on its shares for 1917). The net profits are £27,692, plus £2,595 brought forward. After paying 7 per cent. on the preference and 9 per cent. on the ordinary shares for the year, £5,286 is to be carried forward. Units generated by steam plant, 504,909; purchased, 15,137,913. Sold for private supply, 11,986,051; works, 283,495; batteries, 236,016; transmission and transformation, 2,516,369; distribution, &c., 620,891. Total connections, 17,253 KW.

Blackpool & Fleetwood Tramroad Co.—Dividend 4½ per cent., making 6½ per cent. for the past year.

STOCKS AND SHARES

Tuesday Evening.

The main business in the Stock Exchange markets this week has once more centred around industrial shares and miscellaneous issues of various kinds. Interruption to postal services has again been caused by the familiar air-raid performances, and business thereby checked in many markets of the Stock Exchange, so there is not much going on. More interest is taken in getting away early o' nights than in dealing in securities; some people, in fact, saying that they would prefer for trade to go slowly during the bright evenings, in order that they might leave the city early.

Two of the principal West-End electric lighting companies have issued their reports, and both are good. The Westminster Electric Supply Corporation announces an increase in the sales of current which has brought in £275,000, some £57,000 more than in the preceding year, and the gross receipts of £306,000 are £43,600 up. Increased expenditure is naturally a feature, and the net revenue comes out at £88,200, showing an increase of £22,600. The dividend is raised from 7 per cent. to 9 per cent. for the year, and the carry-forward of £13,300 is £10,000 up.

The St. James's & Pall Mall Co. secured a net profit of £27,700, an advance of about £5,000 as compared with 1916. The carry-forward of £5,300 is just double that of the previous year, and in this case also the dividend is increased from 8 per cent. to 9 per cent. St. James's stand at 7¼, Westminsters Ordinary at 7, and the yields on the shares to an investor at the present prices come to £6 4s. 2d. and £6 8s. 7d. respectively. County of London Preference improved to 11¼, and the market generally is a good one, hopes naturally being current that other companies will follow the excellent example set by the St. James's and Westminster undertakings.

Home railway issues show no further sign of vitality. Prices, in fact, are dull and heavy. Underground Incomes receded to 80½, at which the return to a buyer is over 5 per cent., allowance for the £2 net of dividend included in the present price. The Ordinary shares are down ⅛ at 1⅝. There is no improvement in the other Undergrounds, the market as a whole remaining dull in sympathy with that for the stocks of the steam companies. Central London Assented have reacted.

The best feature of the electrical markets is the noteworthy strength of manufacturing shares. The air is thick with rumours. Just as a matter of interest, we may repeat the report which links the General Electric Co. with Vickers, and which allies Fraser & Chalmers with one or other of the manufacturing concerns. That there are negotiations proceeding between some of these companies would appear to be beyond doubt, and anticipation is kindled to a high degree as to what developments may shortly be announced.* Meanwhile, it is extremely difficult to get hold of shares. General Electric Ordinary at 19½ are 5s. higher. Henleys and Callenders are both 10s. better at 17½ and 15½ respectively. British Insulated at 3¾ are harder. Telegraph Constructions gained £1 at 43. British Westinghouse Preference are ⅛ up at 2 15/16. The movement has spread to others of kindred character. Babcock & Wilcox at 3 5/16 are 1/16 to the good. Other industrials are firm to strong, and their market is the only one in which there is anything approaching animation.

Oriental Telephones have further risen to 4⅛, and the cable market as a whole keeps good without showing any particular movements on the week. Marconis have quieted down again. Several of the subsidiaries are a trifle easier. Americans, for instance, eased off to 25s. Globe Telegraph & Trust Ordinary and Preference are both ⅛ harder at 14¼ and 10¼ respectively.

In the foreign group there is not much going on. Mexicans are passive, as ever. British Columbia Electric issues hold their improvements, and one or two of the debenture stocks of the Anglo-Argentine Tramways are in request. Singapore Trams have gone back a little. A remarkable rise has occurred in the Ordinary shares of the Lancashire United Trams. The price has risen to 4s. 6d., whereas quite lately it stood at half-a-crown and less. British Electric Tractions are better, the Ordinary at 34, and the 6 per cent. Participating Preference at 74. Shawinigan Rights are changing hands freely between 6d. and 9d.

The rubber share market is somewhat dull, with business proceeding on retail lines. Armaments are mostly better, on amalgamation rumours. Base metals keep strong, Australians particularly so. Hydro-Electrics are less buoyant, but the price keeps fairly steady at 13s. Victoria Falls ordinary at 18s. 1½d., and the preference at 22s. 9d., are hardly affected by an easier tendency amongst South African mining shares.

[* A reference to this matter appears in our "Business Notices" to-day.—Eds.]

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price Feb. 19, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3¼xd	—	6 18 6
Chelsea	4	8	2⅞	—	5 4 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11¼	+ ⅛	6 4 5
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	6⅜	—	5 11 7
London Electric	8	Nil	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅜	—	5 18 6
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8½	—	6 13 4
St. James' and Pall Mall ..	8	8	7¼	—	6 4 2
South London	5	5	8	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	[illegible]	7	—	6 8 7
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	33/6	1½	12⅜	—	6 13 4
Chile Telephone	8	8	7½	—	5 10 4
Cuba Sub. Ord.	6	7	9¼	—	*7 11 4
Eastern Extension	8	8	15⅛	—	*5 6 0
Eastern Tel. Ord.	8	8	152½	+1	*5 5 7
Globe Tel. and T. Ord.	7	7	14¼	+ ⅛	*4 18 3
do. Pref. ..	6	6	10¼	+ ⅛	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	18	18	51½	—	6 6 3
Marconi	10	15	3⅛	—	4 16 1
Oriental Telephone Ord. ..	10	10	4⅛	+ 1/16	2 17 2
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan.	6d.	6d.	1 13/16	—	*2 15 2
Western Telegraph	7	8	15½	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	62½	—2	6 9 1
Metropolitan	1	1	22¼	— ¼	4 10 0
do. District	Nil	Nil	15⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	— ⅛	Nil
do. do. "A" ..	Nil	Nil	5/3	—	Nil
do. do. Income	6	4	80½	— ½	*4 19 5
Foreign Trams, &c.	**Dividend 1915.**	**Dividend 1916**			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞xd	+ ⅛	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	45	- 1	—
Bombay Electric Pref.	6	6	9¼	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	46	—	10 17 4
do. do. Preferred	Nil	Nil	30½	+1	Nil
do. do. Deferred	Nil	Nil	23	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	94½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 5/16	+ 1/16	4 10 4
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	3¾	+ ¼	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	+ ⅛	5 2 0
Callenders	20	20	15½	+ ½	6 9 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 9/16	—	5 12 2
Edison Swan, fully paid ..	—	—	2⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1 1/16	— 1/32	6 6 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19½	+ ½	5 2 7
Henley	25	25	17½	+ ½	7 2 10
do. 4½ Pref.	4½	4½	4	—	5 12 2
India Rubber	10	10	14¾		*6 5 7
Telegraph Con.	20	20	43	+1	*5 11 9

* Dividends paid free of income-tax

RUSSIAN ELECTRICITY WORKS STATISTICS FOR 1914.

The following statement of electricity works statistics for 1914 is issued by the *Elektrichestvo*, the official organ of a number of Russian technical and electrical associations. Its publication has been, of course, delayed by the state of war. Nevertheless an effort has been made to make the statement fuller than previous ones, even to the inclusion of data on stations, of which particulars are not available later than for 1908 and some later years previous to 1914. The compilers of the statement have had to be content with such particulars as the owners or managers of the respective plants have been pleased to fill up in the forms sent them. Errors and omissions, particularly the latter, originate therefore more probably with the station owners or managers, than with the compilers.

Place.	Supply authority.	Year of opening.	Supply pressure. Volts.	Frequency and phase.	Total capacity of plant in kw.	Total connections in kw.	Units sold for all purposes per annum.
1 Armavir	Armavir Electricity Co.	1905	220	Direct	565	726	433,125
2 Baku, White Town	Electric Power Co.	1900	1,000 and 2,000	3-phase	36,500	80 257	10[illegible],870,260
Bibi Eybat	Electric Power Co.	1900	2,000	—	11,000	13,733	16,053,161
3 Berdicheff	A. R. Chari, Councillor	1901	2 × 110	Direct	290	558	450,000
4 Bogorodskoye (Nizhegorod)	G. A. Feldman, Engineer	1913	—	- -		499	165,514
5 Byelgorod	Town	1911	2 × 220	Direct	250	-	216,189
6 Voronezh	Russian Siemens & Halske Co.	1899	2 × 120	1-phase	2,000	1,264	1,027,739
7 Glazoff	Town	1912	—	Direct	230	—	
8 Eupatoria	Town	1912	2 × 220 ltg.; 550 tr.	Direct	-	972	32[illegible],185
9 Eisk	Town	1912	2 × 220	Direct	—	239	174,800
10 Ekaterinoslaff, Ltg. & Try.	Central Electric Co.	—	2 × 250	Direct	—	6,528	7,380,460
11 Elabug	Town	1913	2,000/110	1-phase	—	109	115,635
12 Kazan	Town since March 1, 1914	1896	2 × 150	Direct	—	2,929	1,566,552
13 Kostroma	Town	1912	2 × 220	Direct	—	568	492,288
14 Kremenchug	Belgian Electric Tramways, &c., Co.	1899	550 tram., 2 × 115 ltg.	Direct; 1-phase 50 ~	—	2,744	1,359,307 besides trs.
15 Lebedin	Town	1910	—	Direct	—	107	100,862
16 Lugansk	Town	1913	220	3-phase	3,150		
17 Moscow (Tramways)	Town	1907	600	Direct	6,600	56,860	58,280,522
18 Moscow ,, (1886 Co.)	1886 Electric Lighting Co.	1897	2,110/120; 6,600 for long dist.	3-phase	—	103,034	89,799,049
19 Nachichevan on Don	Town	1910	2 × 220; 500 for st. ltg.	Direct	—	1,202	767,766
20 Odessa	Electricity Co.	1912	6,000/217; 10,000/375 for long distance; 120—220	3-phase	—	12 258	6,202,323
21 Orenburg	Town	1898	2,000/120	1-phase		1,321	714,349
22 Pernau	Town	1907	2 × 220	Direct		527	164,600
23 Petrograd (Tramways)	Town	1907	600	3-phase	6,600	—	38,583,588
24 Petrograd	Belgian Electric Lighting Co.	1898	110—120	42·5 ~; 1-phase	2,200	30,493	27,689,680
25 Poti, port	Town	1906	2 × 250	Direct	500	210	93,200
26 Pskoff	Town	1907	2 × 250	Direct		1,474	1,075,476
27 Reval	Town	1913	—	3-phase	2,000	1,318	657,960
28 Rybinsk	Town	1907	2 × 220	Direct		920	469,775
29 Simferopol	Belgian Simferopol Electric Trams. and Lighting Co.	1914	217 and 125; 550 for tramways	Direct	6,600	1,981	949,760
30 Stavropol (Caucasus)	Town	1909	2 × 250: 2 × 500	Direct	—	1,043	551,506
31 Suchum-Kale	Suchum Electric Co.	1909	3,300/125; 500 for street ltg.	3-phase; direct	—	347	381,249
32 Tomsk	Technico-Industrial Bureau and Tomsk Electric Lighting Co.	1896	110—115	1-phase; 50 ~	2,200	—	614,774
33 Uman	Russian Electrical Equip. Co.	1914	3,000/200	50 ~: 3-phase	368	171	55,285
34 Karkoff	Town	1896	2 × 125 ltg.; 250 for motors; 600 for trams. and street ltg.; 3 × 190 and 110	Direct and 3-phase	—	10,357	8,163,722
35 Alexandrovsk	Town	1910	2 × 220	Direct	500	712	413,302
36 Warsaw (Tramways)	Town	1908	—	Direct	6,000	8,832	8,559,390
37 Grodno	Town	1912	2 × 220	Direct	—	557	193,540
38 Melitopol	Town	1901	2 × 250	Direct	500		341,587
39 Mohilieff Podolia	Electric Light Co.	1912	—	Direct	—	217	108,242
40 Penza	Ya. Milman & Ph. Titoff	1907	220	Direct	—		—
41 Petrograd (1886)	Electric Light Co., 1886	1898	2,200/120; 6,000/120	3-phase	—	57,562	53,430,850
42 Riga (Lighting)	Town	1904	—	3-phase	3,000	13,271	6,371,625
43 Rostoff, Yaroslaff	Town	1905	2 × 220	—	410	626	529,895
Data for 1912.							
44 Balaklava	Town	1911	—	—	—	44	26,000
45 Batoum	Town	1900	2 × 250	—		188	224,290
46 Bisk	Electric Light Co.	1900	—	1-phase		—	62,500
47 Warsaw (Lighting)	Warsaw Electricity Co.	1903	5,000/125; 2 × 220	50 ~; 3-phase		—	11,199,350
48 Wilna	Town	1903	2 × 220	Direct	—	-	1,547,362
49 Vladivostok	Town	1912	2,200/220 lighting and motors; 550 600 trams.	3-phase Direct	—	1,509	1,080,614
50 Vologda	Town	1904	220	Direct	250	92	149,361
51 Ekaterinodar (Lighting)	Town	1906	—	—	-	1,144	1,128,060
52 Ekaterinodar (Tramways)	Belgian Tramway Co.	1900	—	—	-	3,583	2,367,743
53 Ekaterinoslaff (Trams.)	Ekaterinoslaff Tramway Co.	1897	—	Direct	—		1,995,000
54 Zhitomir	Russian Town and Feeder Lines Co.	1899	2 × 230 trams. and lighting and 550 tramways	Direct	—	1,156	950,241
55 Irkutsk	Town	1910	275	1-phase	2,000	1,765	1,012,692
56 Kovna	Kovna Electric Lighting Co.	1900	2 × 110	Direct		1,001	608,508
57 Kieff	Kieff Town Tramways	1890	—	Direct	600	14,043	13,378,921
58 Libau	Société Cont. de Traction et d'Eclairage par l'Electricité	1899	2 × 220 lighting, and 500 tramways	—	—	3,715	2,133,788
59 Lodz (Lighting)	Lodz Section of the 1886 Co.	1908	3,100/120	50 ~; 3-phase	—	26,011	31,701,417
60 Lodz (Tramways)	Lodz Electric Tramways Co.	1898	—	—		—	3,994,300
61 Novgorod Syevyersk	Town Mutual Insurance Co.	1901	—	Direct	500	—	56,000
62 Novocherkask	Town	1900	2 × 110	Direct	—	866	588,689
63 Pavlovsk	Pavlovsk Electric Co.	1911	2 × 240	Direct; 3-phase	—	162	103,075
64 Petrograd	Petrograd Electric Equip. Co.	897		-	3 0[illegible]	—	22,90[illegible],666
65 Poltava	Town	1900	2 × 125, & to add 2,100/190/110	Direct	—	658	411,013
66 Rostoff on the Don: Lighting	N. Y. Smirnoff, engineer	1909	— —	50 ~; 3-phase	2,000	2,376	
67 Rostoff on the Don: Tramways	Belgian R. o/D. Electric Tramways Co.	1901	550 tramways	—	550	4,000	3,041,000
68 Smolensk	Smolensk Electric Co.	1901	550 trams.; 2 × 220 lighting	Direct	—	1,573	1,032,148
69 Tver	Tver Elec. Tram. & Light Co.	1901	2,400 for trams.; 110 lighting	Direct; 3-phase	—	1,319	695,294
70 Chabarovsk	Electric Power Co.	1906	2 × 220	Direct	—	767	496,700
71 Kerson	Town	1908	2 × 275	Direct	—	1,125	718,773
72 Tzechotzinsk Health Resort	Tzechotzinsk Treasury Water Cure Establishment	1902	—	Direct	—	—	26,240
73 Chernigoff	Town	1893	2 × 220	Direct	—	542	260,499
74 Yalta	Town	1904	2 × 220	Direct	—	880	466,000
Data for 1908–1911.							
75 Elizabetgrad	Town	1908	2 × 220	Direct	—	—	689,294
76 Minsk	Town	1904		—	—	—	638,781
77 Nikolaieff	Town	1902	2 × 220	—	480–600	—	1,888,967
78 Yaroslavl	Town	1900	2 × 230	—	—	2 189	(1,510,000)
79 Byelostok	Berlin Electrical Concerns	1910	—	—	—	1,114	697,362
80 Vladimir	K. A. Russakoff, Engineer	1908	2 × 220	—	—		106,[illegible]
81 Viatka	Town	1903	2 × 220	Direct	—	966	553,852
82 Kishinieff	Town	1909	2 × 220	Direct	—	671	423,000
83 Nikolsk Ussurisk	Ussurisk Electricity Co.	1908	—	Direct	—	302	231,000
84 Upha	N. V. Konshin	1898	2 × 220	Direct	—	607	430,86[illegible]
85 Chita	N. P. Polyakoff & Co.	1906	2 × 250	Direct	—	500 (about)	36,000 (about)
86 Astrachan (Tramways)	Private	—	—	Direct for trams.	—		1,424,[illegible]
87 Berdiansk	Town	—	2 × 220; 540, street lamps	Direct	—	125	134,869
88 Kieff	Private	—	2,200 to 190, & to 2 × 110 alt.	3-phase; direct	[illegible],200; 50	14,271	10,946,507
89 Taganrog	Private	—	2 × 110	Direct	—	(151)	40,000
90 Perm	Town	—	2 × 220	Direct; 3-phase		1,192	722,611
91 Radom	Private	—	2 × 220; 2,200/110	Direct	—	5[illegible]1	401,000
92 Riga (Tramways)	Private	—		—	—	—	—
93 Samara	Town	1899	2,000/120	3-phase	—	372	222,445

CO-OPERATION FOR AFTER-WAR EXPORT TRADE.

We make the following extracts from an important article in the series on "After-War Trade" appearing in the Board of Trade *Journal*. The matter is referred to in our leader columns to-day:—

In the course of their inquiries, the After-War Trade Departmental Committees considered the instruments which the commercial nations of the world have created for the distribution and export of products and the expansion of trade. Their purpose was to determine, as far as they could from the evidence before them, how far our own existing trade methods were likely to be effective after the war; to consider the strength and character of future competition, and to determine whether any changes in our trading methods are expedient.

The export trade of the United Kingdom has been built up by individual effort, and, in consequence, exhibits several varieties of organisation. In great part, the distribution of products in external markets has been the function of merchants who have bought freely from any producer, though in some cases merchants have become attached to a particular manufacturer as his agent or partner, and in other cases the manufacturers themselves have established strong direct connections with individual markets. In spite of the very considerable achievements resulting from these various methods in the past, the Committees were generally of opinion that they called for very careful reconsideration in the light of changed conditions and foreign methods.

The Committee which investigated the Iron and Steel Trades anticipate that competition in external markets is likely to be severe after the war, as a result of the enormous increase in the world's production of steel. They are persuaded that only solidarity of action will enable the iron and steel industries of the United Kingdom to maintain and improve their position in the markets of the world. They approve generally of the principle of concerted action in the commercial distribution of manufactured iron and steel goods. It is possible that in the case of highly specialised products its application might not be necessary, but they are convinced of its value in respect of the bulk of iron and steel products.

Associations of this character are not necessarily of uniform organisation. Thus in the engineering trades, the Committee mention a system of small co-operative limited companies, the capital being subscribed by the interested firms. The sole business of such selling companies is to push certain lines of goods manufactured by the subscribers. The goods sold in each case are mutually non-competitive. Each manufacturer is limited as to the products which he is entitled to have sold through the agency, which thus acts as selling agent for a large number of manufacturers of distinct, though perhaps allied, products. The main criticism of this system made to the Committee was that the agency, having no special interest in any particular product, followed the lines of least resistance, and consequently pushed those goods which met with a ready local acceptance at the expense of the manufacturers whose goods did not sell so easily.

"It appears to us that such selling agencies can usefully be employed in the early stages of a firm's operations in a new country," the Committee state. "When a *clientèle* has been collected, the firm if sufficiently large, may probably find that separate representation will best meet its interests." The whole system of pushing export trade requires a somewhat bolder treatment than it has received up to the present. We believe that the excellence of British goods is everywhere acknowledged, and that if satisfactory arrangements can be made as to the giving of credit in proper cases, and greater attention is given to prompt delivery, the export trade of this country can be very largely increased.

The Committee add:—"In the engineering trades of the United Kingdom the working of trade combinations leaves much to be desired. In the United States such combinations as a rule seem to take the form of amalgamations. In Germany trade combinations take form in the well-known cartels. In the case of both countries the object aimed at is, especially by supporting experimental investigations and scientific departments, to co-ordinate production, to promote efficiency, to eliminate waste, to push home trade, to facilitate export trade, and to unify selling arrangements. In both of these countries the ideal at which trade combinations aim is the maximum of production at the minimum of cost. In this country, so far as we have been able to ascertain from the evidence before us, trade combinations exist only for the purpose of maintaining home prices. Even in this respect they are difficult to keep going, as a violent slump is apt to bring such a combination to an end. Apparently we had in this country before the war few combinations having for their objects the co-ordination of production, the pushing of trade, the elimination of waste, the facilitating of export trade, or joint selling arrangements, though we understand that there are some amalgamations which have to some extent effected this object."

Very emphatic views on the advantages of combination to promote joint interests in the export trade are expressed in the following statement by the Committee reporting on the electrical trades:—

"For several years past there has been in Germany a consistent policy of amalgamation and association, and several establishments of world-wide importance have thus been built up. Only two or three German companies are seriously engaged in the electrical business overseas, and the competition which British manufacturers have to face is almost entirely with these houses. But these competitors, though few, have immense resources, with highly trained staffs and competent workmen, their factories are well equipped, they have established branches all over the world, and maintain elaborate research laboratories. They have enormous financial strength, for, in addition to their own capital, they are closely bound up with leading financial institutions not only in Germany, but elsewhere on the Continent, in a manner which does not exist in Great Britain.

In contrast with this policy of association, which has proved so successful both in Germany and in America, Great Britain has always discouraged combination, fearing a rise in prices to the detriment of the consumer. As a result of this policy of isolated effort, numbers of small concerns have arisen, each struggling against the other for bare existence. By association it would be possible to manufacture each class of apparatus in the most suitable factory, the management of which would thus be concentrated on its own speciality instead of being wasted on a variety of products. It is essential that output should be thus consolidated instead of remaining in the hands of a number of weak concerns, many of which, moreover, have further reduced their competitive power by dabbling in a variety of productions. The Committee is convinced that under properly organised combination or association the cost of production will be materially reduced, and that there is no reason to fear that enhanced prices will be charged to the consumer as a result of such combination.

"If electrical factories, which are unquestionably necessary on national considerations, are to be maintained in a state of efficiency, steps must be taken at the earliest possible moment to deal with the problem. A sound and permanent industry can be established not only to supply the home market, but to secure a much greater proportion of the overseas trade of the world. This can be done either by amalgamation among the companies engaged in the industry or by the development of the practice of association for common purposes. In whichever direction action be taken, the Committee is convinced of the need for reform. Only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations, which not only manufacture, but undertake comprehensive contracts, make powerful financial alliances, and thus exert in every direction greater influence than is possible in the case of any individual firm."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Improved Type of Outdoor Terminal Box.

For terminating underground cables at the terminal poles of an overhead transmission line, an inverted type of box is usually employed, *i.e.*, a box from which the insulators point in a downward direction. There are several types of box at present used which answer to this description, and the majority of them are fitted with insulators which require protection from the weather to render them in any way suitable for the work for which they are intended. These insulators are usually shielded by separate castings of bell shape, fixed to the box by screws, or similar means, or a shield is cast solid with the box.

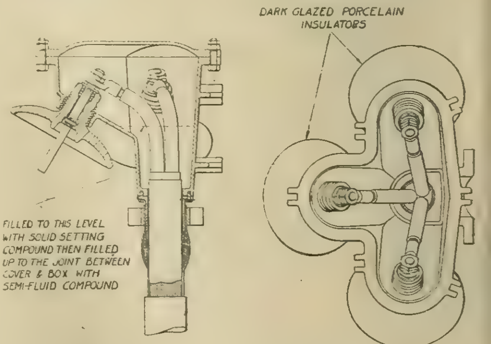
DARK GLAZED PORCELAIN INSULATORS
FILLED TO THIS LEVEL WITH SOLID SETTING COMPOUND THEN FILLED UP TO THE JOINT BETWEEN COVER & BOX WITH SEMI-FLUID COMPOUND

Fig. 1.—B.I. & H.C. Outdoor Terminal Box.

The disadvantage of protecting the insulator in this fashion is that the efficiency of the insulator is diminished, owing to the radial distribution of the electrostatic field between the conductor and the shield, as compared with a longitudinal distribution of the electrostatic field, more or less parallel to the conductor, when no shield is used; hence there is a tendency to diminish the factor of safety.

It is evident, therefore, that if metal shields are used, apart from protecting the insulators so that the latter can insulate, they should be so far removed from the conductors as will provide a reasonable factor of safety. Obviously, this means, in the case of boxes used on H.T. or E.H.T. circuits, that the shields must necessarily be of large dimensions; consequently the box is large, and the amount of compound liquid required to fill it is considerable.

With a view to getting rid of the disadvantages of metal-shield protection of insulators, and at the same time providing a box with a high factor of safety, but of comparatively small dimensions, the box illustrated in fig. 1 has been developed and patented by the **British Insulated & Helsby Cables, Ltd.**, of Prescot, Lancs. The insulators of this box do not require protection, as they are so shaped that they are self-shielding. The disk formation of the insulator prevents rain from having access to a part of the surface of the insulator which lies between the bare conductor and the earthed box, so that under the worst of working conditions there is always sufficient insulation to prevent a flash-over.

A box designed for working at 11,000 volts was fitted up and tested, with the following results:—

Flash-over, dry	65,000 volts.
Flash-over, wet (under heavy spray) ...	58,000 volts.

In the dry test the arc was over the surface of the insulator, but in the wet test the arc bridged the gap between the lip of the insulator and the box. Considering that this box for 11,000 volts, 3-core cable, is so small that it takes only 26 lb. of compound to fill it, it will be appreciated that these results are highly satisfactory.

The insulators are arranged so that they can be readily replaced in the remote event of breakage, the compound above the fork of the cable being of a semi-fluid consistency. They are also provided with hemp threads, and are screwed into the box, the hemp acting as the male thread. The use of hemp in this way provides a flexible joint, thus obviating the possibility of fracture, due to vibration (Patent No. 105,586/16).

The box is arranged for filling with compound to the level of the machined joint between box and cover, and as the cover is domed, allowance is made for the expansion of the compound which will take place when the box is subjected to heat. Cases are known where boxes have cracked, due to the lack of such provision.

The brass gland for wiping to the lead of the cable is arranged for attachment to the box in such a way that the wiped joint may be made away from the box, and the hole in the box for receiving the gland is of such size that it is possible for the terminals, when sweated to the cable cores, to be passed through. This permits of all the jointing being done on the ground, thus reducing the cost thereof, and simplifying erection.

B.E.V. Electric Industrial Truck.

The British Electric Vehicles, Ltd., of Hoghton Street, Southport, are manufacturing two sizes of electric industrial truck, viz., for half and one-ton loads, but a light and heavy-duty pattern is made for each of these loads. The light-duty pattern is intended for level runs on good surfaces, while the heavy-duty type is designed for use on rough tracks, and to climb gradients up to 1 in 20 for the half-ton, and 1 in 10 for the one-ton machine. The loading space for all types is 6 ft. × 3 ft.; 27-cell, 50-volt Chloride "Ironclad" batteries of 60 and 96-ampere-hour capacity are fitted to the half and one-ton sizes respectively. Special ball-bearing motors and controllers with renewable fingers and contacts, giving three speeds in either direction, are provided; the frame is of riveted steel, fitted with solid rubber-tired wheels, chain drive from motor to rear wheel, and the rated speed is six to seven miles an hour, and rated mileage on the level, 20 to 25 miles per battery charge.

These trucks are guaranteed against defective material and workmanship for 12 months, and undergo full tests before dispatch.

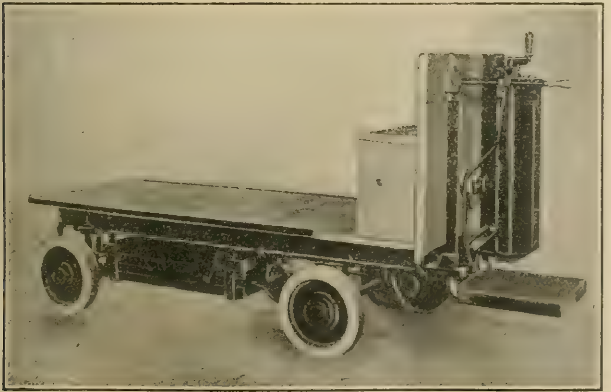

Fig. 2.—B.E.V. Electric Truck.

REVIEWS.

Manual of Reinforced Concrete. By C. F. Marsh, M.Inst.C.E., and W. Dunn, F.R.I.B.A. London: Constable & Co., Ltd. Price 10s. 6d. net. XVI + 475 pp., 191 illustrations.

This is the third edition of the work, and has been re-written and considerably enlarged. The standard notation proposed by the Concrete Institute for formulæ has been adopted, and a variety of new methods of calculation, new diagrams, &c., has been incorporated in the volume, which now comprises 475 pages.

After treating of the materials employed, methods of construction, and the behaviour of reinforced concrete structures with regard to water, fire, &c., the authors proceed to the discussion of loads, bending moments, and shearing forces on structures of various types, giving abundant data bearing upon the requirements of practical conditions. Many of the subjects dealt with are of immediate interest to central-station engineers, such as the pressures on retaining walls, coal storage bins, &c. This part of the book occupies nearly 100 pages, and is followed by one twice as long, dealing with methods of calculation, with the aid of numerous diagrams which facilitate the quick determination of the required values required by graphical means. The last part gives general information, tables, &c., bearing upon the subject. A prominent feature of the work is the use wherever possible of handy methods by which the evaluation of formulæ is largely avoided, and the time of the user is economised, and the work is evidently intended to meet the needs of the engineer who is actually engaged in the design and erection of ferro-concrete structures. It contains a mass of practical information which should render it indispensable to those concerned in such operations.

Handbook of Machine Shop Electricity. By C. E. Clewell. London: Hill Publishing Co. Price 12s. 6d. net.

This work is a somewhat curious Olla Podrida-like collection of matter. The compiler explains in his prefatory remarks that the book has been prepared primarily for the practical machine-shop man, and is offered as a reference-book and guide to the practical everyday applications of electrical energy in workshop operations. A laudable object, surely, but after a close perusal of the compiler's chosen subjects and his methods of treating the matter one is forced to the conclusion that the really practical average machine-shop man will get somewhat confused in his interpretation of many of the more important branches dealt with, and the reviewer is inclined to think that some of the guidance tendered is not very helpful.

The work is divided into 10 sections, which are further split up into sub-divisions, the various subjects in each section being arranged alphabetically. The explanatory text is generally clear, but there is much redundant matter, and many superfluities and useless repetitions that appear might with advantage have been omitted.

Section 1 is mainly a dictionary of terms, &c. In Section 2 on "Circuits," systems of transmission and distribution are discussed, and the reader is taken rapidly from conduit running to manhole construction, resuscitation from electric shock, screws and nails, &c. Wiring is resumed, and runs on for some 30 pages, when a pause is made to consider Ohm's Law and its practical applications. The matter on costs, in Section 3, can hardly be considered as having any practical value, on this side of the water at least, and the reader is advised to check the prices given against quotations from manufacturers. Section 4 contains quite a lot of interesting reading on communication and control, illustrated descriptions of many useful devices applicable to everyday shop wants being given herein.

Too much has been attempted in Section 5; the reader is hustled on from questions of efficiency to rheostats, machinery foundations, "grounds," machine details, and thence to parallel operation, stopping a brief spell to look at a picture or two of Edison and other cells, until he arrives breathless at a conventional line diagram of the Scott transformer connection. Following a 12-line description of the function of slip-rings, this chapter ends rather abruptly with a meagre and not very lucid sketch of the static transformer.

Section 6 gives some interesting information about electric soldering and welding, but the data tabulated are not by any means up to date as representing modern shop systems.

The use of the magnet or clapper switch is discussed in Section 7, and some data on the lifting magnet appear. Sandwiched between them one finds mention of magnetised hammers, screw-drivers, and such-like small tools, also wrinkles on the demagnetising of watches, and, later, the extraction of metal particles from the eye is mentioned. The electric heating of various shop tools is described, and magnetic chucks are discussed at some length.

In Section 8, on lamps and shop lighting, the requirements for good factory lighting are considered according to the code of the Illuminating Engineering Society of New York, the 11 articles of the said Society's creed being reproduced *in extenso*. A description of lamps and fittings which follows does not mark any advance by comparison with modern practice on this side.

Measuring instruments and measurements are dealt with in Section 9. Various A.C. and D.C. switchboard instruments, photometers, and pyrometers are shown and illustrated, and a short abstract of an article on shop operations analysed by graphic meters is given. The power-factor indicator is rather summarily dismissed in a brief half column. The voltmeter, watt-hour meter, and wattmeter are collectively disposed of in less than 20 lines of text, notwithstanding the important part played by the indispensable wattmeter in A.C. power measurements. The handy detector galvo., and the universally-used magneto form of insulation-resistance test sets seem to have been entirely overlooked as shop accessories.

The last chapter, Section 10, deals with motors and applications. Some good information on various forms of driving is given, and numerous types of switch control are described. The method of putting fuses on the "live" side of the main switch, as shown, is bad practice. The tabular data on the power required to drive machine tools should be useful to those who have to deal with shop tool layouts. Fourteen pages are devoted to the care of motors, and much advice of a really practical nature is given. Towards the end of this section details of machine design, both A.C. and D.C., are discussed at considerable length, the explanatory sketches being good and clear. The volume ends after disposing of ventilating systems in four pages, no reference being made to the electrically-driven fan or blower as applied to modern foundry-cupola and smithy practice. An index of nearly 2,000 references is provided.

In the opinion of the reviewer this work fails to achieve its avowed object; as an electrical encyclopædia it may have some claim to consideration by the class of reader to whom it is proffered. The compiler and his collaborators have evidently been to no small amount of trouble in collecting material for this compendium, but the technical reading public—on this side of the Atlantic at any rate—in search of daily provender have long been wise in discriminating between collected catalogue matter and really reliable information for the practical engineer. The volume is profusely illustrated, in fact, rather too much so, many of the figures showing external perspectives of proprietary apparatus being more suitable for the respective makers' lists. Many of the illustrations might with advantage be omitted altogether as being in no wise helpful to a comprehension of the text. The A.B.C. classification is irritating, amounting almost to a fetish, and much has been sacrificed thereby. Apart from a few obvious typographical slips the book is a good example of the printer's craft, and is of convenient pocket size, and pleasing appearance externally.—S. L.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,988. "Electric switchgear." H. W. Clothier, R. M. Longman and A. Reyrolle & Co. February 4th.

2,006. "Electric conductors." G. Fuller and Fuller Wire & Cable Co. February 4th.

2,018. "Thermic telephones and microphones." Naamlooze Vennotschap de Nederlandsch Thermo-Telefoon Maatschappij. February 4th. (Holland, March 27th, 1917.)

2,029. "Devices for locking incandescent electric lamps, &c., to sockets or holders." H. R. Nixon & W. Peddie. February 4th.

2,030. "Electric contacting devices." A. B. Field, A. C. Heap & Vickers, Ltd. February 4th.

2,031. "Electric contact-actuating mechanism, and systems for employing same." A. B. Field, A. C. Heap & Vickers, Ltd. February 4th.

2,032. "Electrically-controlled devices." A. B. Field, A. C. Heap, and Vickers, Ltd. February 4th.

2,040. "Combined air-cooled ignition plug and auxiliary air inlet for internal-combustion engines." J. Chapman. February 5th.

2,047. "Electric generators." A. H. Neuland. February 5th.

2,051. "Electric flash-preventing device." W. R. Cooper. February 5th.

2,072. "Change-over switch for spare electric transformer, &c." P. J. Monks. February 5th.

2,077. "Electric governing devices." A. Lyon & Wrench, and J. C. Todman. February 5th.

2,081. "Electric fuse boxes." W. T. Henley's Telegraph Works Co. and E. E. Judge. February 5th.

2,089. "Systems of electrical distribution." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 5th.

2,095. "Sparking plugs for internal-combustion engines." L. S. Clarke. February 5th.

2,102. "Filament glow lamp for electric searchlights." V. Burri. February 5th. (Switzerland, January 31st, 1917.)

2,112. "Method of retaining the maximum spark on a magneto with unlimited range of advance and retard." L. Hollins. February 6th.

2,116. "X-ray fluorescent screen attachment for localisation of foreign bodies." W. J. Barnicoat. February 6th

2,117. "Sparking plugs." M. Lacroze. February 6th.

2,120. "Means for cooling and ventilating electric motors and dynamos." E. Harris. February 6th.

2,134. "Removable electric fuse carriers or connecting devices." British Insulated & Helsby Cables, Ltd., and L. B. Wilson. February 6th.

2,146. "Protection of windings of electric generators, &c." A. Collins. February 6th.

2,153. "Machine switching telephone systems." G. Deakin, J. G. Hackley, L. Polinkowsky, & Western Electric Co. (C. E. Stevens partly and Western Electric Co., U.S.A.) February 6th.

2,164. "Controllers for electric motors." J. C. Kelso. February 6th.

2,184. "Switch or fuse contacts." F. J. Gill. February 6th.

2,208. "Removable electric fuse carriers or connecting devices." British Insulated & Helsby Cables, Ltd., and L. B. Wilson. February 7th.

2,235. "Electromagnetic switches." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 7th.

2,264. "Searchlights." E. A. Sperry. February 7th. (U.S.A., February 7th, 1917.)

2,265. "Electric heating systems." C. R. Matthews, R. J. A. Pearson and Vickers, Ltd. February 7th.

2,287. "Sparking plugs." A. G. France. February 8th.

2,293. "Microphones." P. J. Hackett. February 8th

2,317. "Cleat for supporting electric cables." A. Lappin. February 8th.

2,324. "Electrically-actuated registering mechanism for indicating or signalling systems." E. A. Graham. February 8th.

2,340. "Self-locking electric light fittings, &c." J. P. Annacker. February 9th.

2,348. "Switch apparatus for electric hand lamps, &c." Efandem Co. and A. H. Williams. February 9th.

2,349. "Electric lamps carried by handle projecting therefrom." Efandem Co. & A. H. Williams. February 9th.

2,368. "Electric furnaces." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 5th.

2,380. "Sleeve inductors for ignition magnetos." A. R. J. Foster and Selsdon Aero & Engineering Co. February 9th.

2,384. "Electric cells." C. Fery. February 9th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,009. Apparatus for Regulating the Voltage of Dynamos. A. J. Jullin. June 16th, 1914. (Addition to 15,008/16.) (101,888.)

15,010. Apparatus for Regulating the Voltage of Dynamos. A. J. Jullin. July 28th, 1914. (Addition to 15,008/16.) (101,889.)

17,529. Dynamo-electric Machine for the Conversion or Simultaneous Production of Alternating Currents of Different Frequency. Bergmann Elektricitats Werke Akt. Ges. December 8th, 1915. (102,618.)

1917.

686. Magnetic Material Suitable for use in Static Transformers and other Electrical Apparatus. A. F. Berry. January 13th, 1917. (112,649.)

740. Automatic Telephone Systems. Relay Automatic Telephone Co. January 15th, 1917. (112,650.)

749. Phase Transformation of Electric Currents and Transformers therefor. British Electric Transformer Co. & R. Crosbie-Hill. January 15th, 1917. (112,651.)

819. Dynamo-electric Machines. H. F. Joel & F. P. Fletcher. January 16th, 1917. (112,655.)

931. Electric Couplings, and Cases therefor. N. J. Austin & G. E. Taylor. January 18th, 1917. (112,664.)

955. Electric Switches. K. Horn. January 19th, 1917. (112,667.)

4,558. Engine Starter. V. Bendix. March 29th, 1917. (112,702.)

5,292. Electric Regulators. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 14th, 1917. (112,708.)

5,941. Electric Switches. H. B. Butler. April 27th, 1917. (112,711.)

7,092. Electric Fuses. E. G. Nicholls. May 17th, 1917. (112,717.)

7,629. Sparking Plugs for Internal-combustion Engines. R. L. A. Burgognon. May 26th, 1917. (112,720.)

9,169. Electrical Furnace for Hardening Steel and the like. L. W. Wild & E. P. Barfield. June 26th, 1917. (112,731.)

9,558. Electrically-operated Riveting, Pressing, Stamping, and the like Machines. E. Adamson. July 3rd, 1917. (112,733.)

10,710. Prismatic Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 25th, 1917. (112,738.)

10,896. Electric Switches. C. P. Drescher. July 28th, 1917. (112,740.)

14,402. Spark Plugs. H. L. Boudreau. June 2nd, 1917. (112,752.)

Electroculture at Warrington.—The Corporation Electricity Committee and the local Small Holdings and Allotments Committee are to co-operate in a series of experiments in electroculture, which are to be carried out on a portion of the acreage in Victoria Park, which is to be planted with potatoes this spring.

THE

ELECTRICAL REVIEW.

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MANUFACTURERS AND PRE-WAR CONTRACTS.

A committee appointed by the Board of Trade in April, 1917, to consider the position of British manufacturers and merchants in relation to contracts entered into by them before the war, has recently issued its report. In the nature of things, it was hardly to be expected that the Committee could or would prescribe a sovereign remedy for all the hardships brought about by the war, and we are not surprised to find that the report contains the following paragraph:—"We cannot too strongly emphasise our opinion that the best possible solution of the difficulties we have been considering lies in the extension of this spirit of compromise. We are confident that as it has already solved many of them, it will solve most of those that remain."

This finding might almost be regarded as axiomatic. Were litigants ready and willing to compromise their differences the Law Courts might close their doors. But alas! compromise is, and must always be, based on a recognition by each party that there is something to be said for the views of the other side, and there are those who will listen to no compromise except the full recognition of their legal rights.

To give the Committee its due it is necessary to appreciate the extraordinary difficulty of the problem it had to consider. It had to inquire into contracts between persons in the United Kingdom, and between English subjects and "persons or companies in the United Kingdom or in allied or neutral countries." If the rights of British subjects *inter se* have to be settled our legislation or our Courts may be able to do justice; but different considerations arise when one party to a contract is a Frenchman or a Swede. He will look upon the matter from a different standpoint.

Let us state quite briefly what the law was as to the performance of pre-war contracts, and then indicate to what extent it has been modified by legislation. It is not until these points are considered that the recommendation of the Committee can be adequately understood.

Primâ facie, if a man binds himself by contract unconditionally to do that which turns out to be impossible he will be held to his bargain, and must pay damages for his failure to perform. Where, however, the contract becomes impossible of performance, relief will be granted. But impossibility here means commercial impossibility. Mere increased cost of performance, unless to an enormous and extravagant extent, does not make it impossible. A man is not prevented from performing by economic unprofitableness unless the pecuniary burden is so great as to approximate to physical prevention.

Impossibility, for this purpose, covers the case where a man is prevented by the performance of the contract being illegal—as when it involves trading with the enemy, or an infringement of regulations made under the Defence of the Realm Act. So it has been held that a mere rise in freights at sea is no excuse for the non-performance of a contract between an English merchant and the subject of a neutral State.

This being the state of the law at the beginning of the war, it is obvious that it cannot be strictly applied without very considerable hardship. That hardship in the main falls upon the seller, and not on the buyer. The buyer who has made a forward contract hopes to be able to sell again. If he had a contract running when the war broke out, he was able to advance his prices to the consumer. The seller, on the other hand, who stood committed to certain prices on August 4th, 1914, had no redress. The fact that relief is sought by seller rather than buyer is borne out by the fact that of the witnesses who gave evidence before the Committee, the vast majority were contractors, manufacturers, sellers, and suppliers. In only a few instances did the buyers, or consumers, or others similarly concerned come to emphasise their position—the fact being, of course, that they were, in the main, content with the present position of affairs.

The existing remedies open to a party who cannot perform his contract are as follows:—At a very early date an Act was passed which enabled the Court to stay execution on a judgment if the breach of contract which led to the judgment was due to the war. The Court in bankruptcy, too, may refuse to allow a man to be made bankrupt in a similar case. It is to be observed that this measure of relief only extended to the enforcement of remedies. It did not relieve a contractor from his obligations. Last year, however, very much wider powers were conferred upon the Courts. In July, 1917, another Act was passed under which, in the case of any pre-war contract for the construction of any building, or work, or for the supply of materials for any building or work, if the Court is satisfied that the contract cannot be enforced according to its terms without serious hardship, it may be annulled or suspended on prescribed conditions. The Court must, however, be satisfied that the non-performance was due to lack of materials or labour owing to the war, and may not make any provision for compensation to either party, nor has the Court power to frame a new contract for the parties.

It is important to notice that these powers extend only to building and works contracts. The manufacturer who is under a pre-war contract to supply machinery could not invoke these powers of the Court.

But the Act of 1917 goes somewhat further. In the case of any contract—not merely a pre-war contract—if any of its terms cannot be performed without serious hardship owing to what may be briefly termed Government interference, the Court may order its suspension or annulment. Note that this power applies to any contract made at any time. It gives relief from liability when the fulfilment of a contract has been interfered with by the action of a Government department, or of a competent naval or military authority.

While the Act of 1917 does not in either case give the Court direct power to vary a contract, it does so impliedly, because, instead of having his contract annulled altogether, the party who desires that it shall be enforced according to the letter may consent to some reasonable variation of the terms. In this sense, therefore, a considerable measure of relief has already been extended to those who are suffering from the burden of pre-war contracts.

Many of the witnesses urged that all contracting parties who have sustained loss through the advance in the cost of material and wages should be recompensed by the Government. The Committee, however, does not approve of compensation unless the loss involved is due to the direct interference of the Government. It suggests, nevertheless, that an allowance might be made—it being assessed under the principle administered by the Defence of the Realm (Losses) Commission. Subject to its pious invocation of the spirit of compromise, this is practically its only recommendation.

To a suggestion that there should be a general cancellation of contracts, the Committee replies that as many contracts of the kind under consideration were made with British subjects, the effect might prove disastrous to British credit. The only hope of adjusting differences between English manufacturers and subjects of neutral and allied countries lies in the establishment of some kind of international court of arbitration.

It is conceived that a study of the foregoing outline of the Committee's report must lead to the conclusion that the manufacturer must rely mainly upon the spirit of compromise. If the Committee has not seen its way to recommend payment of compensation for all losses out of public funds, it is unlikely that Government will undertake the burden, having regard to the present financial position of the State. For our own part, however, we cannot see why the very substantial measure of relief already granted to contractors for works and buildings should not be extended to manufacturers. It is true that, owing to daily additions to the number of articles which cannot be purchased without an "A" Certificate from the Ministry of Munitions, cases of Government interference are becoming more and more numerous. In such cases relief may possibly be obtained under the second provision of the Act of 1917. But there are numerous cases where the fulfilment of orders for machinery is being held up owing to the "diversion or insufficiency of labour" occasioned by the present war. In our opinion the law should be modified so as to give the manufacturer rights as valuable as those which are at present enjoyed by the builder and the contractor for works.

Electric Railway Results.

The reports of the past year's working on the railways which are wholly or partially operated by electric traction cannot but be gratifying to those who, like ourselves, have consistently advocated the electrification of the suburban railways of this country. In spite of a vast amount of discussion, the movement has made comparatively slow progress—out of the maze of steam railways in the Metropolitan district, only some 200 miles are as yet converted to electric traction; the directors have dallied with the subject, have even admitted the probability of success, but have excused themselves from carrying out the work on the ground of uncertainty as to the best system, or other feeble objections. Nevertheless, some progress has been made, and from time to time a section of steam railway has been electrified—with the immediate result that the traffic has increased at an unexpected rate, while the expenses have remained stationary, or have been reduced. The success of the South-Western electrification, like that of the Brighton system, has been immediate and phenomenal; no fewer than 10,000,000 additional passengers have been carried during the past year, and as the chairman remarked at the annual meeting, houses in the district served are now unobtainable. The improvement in the service given can only be appreciated by those who are familiar with the conditions obtaining both before and after the change. The new service on the North-Western line to Watford has also exceeded all anticipations. Unfortunately, the war has for the present put a stop to the various developments contemplated by these companies. We hope, however, that they will proceed with their schemes at the earliest opportunity, with the confidence engendered by the success already attained on their own and other London suburban systems; the results are not in doubt—nor have they been, since the London Bridge-Victoria section of the Brighton system was electrified eight years ago. All that was wanting to emulate that success was the will to act with energy and zeal, and we hope that not only these, but also the Great Eastern and South-Eastern companies will take vigorous steps towards reform the moment they are permitted to do so.

TEMPERATURE EFFECTS IN DIRECT-CURRENT METERS.

By G. W. STUBBINGS.

The effect of temperature on the accuracy of electricity meters is frequently treated as if it were of small importance, and the high temperature coefficient of a mercury meter is not often regarded as a disadvantage. A little consideration will show that this view is not a sound one. A temperature variation of 3° C. will cause an alteration in the accuracy of an unshunted mercury meter of about 1 per cent. To compare the performances of two such meters, the one fixed in the living room of a house, or in a cupboard leading out of the same, and the other in the basement, the average temperature of the first in the winter months during its hours of working will be in the neighbourhood of 20° C., whilst the temperature of the other may average not more than 8° C. As the difference in temperature will be 12°, there will be 4 per cent. difference in the accuracies of the two meters. In view of the importance of this matter of the temperature coefficient of meters, a brief investigation of the magnitude of this coefficient for meters of various types, and of the factors which cause it to be modified, may not be uninteresting.

The case of an unshunted meter may first be considered. Let ω be the angular speed of the rotor, R the specific resistance of the material of the brake disk, B the braking flux; the eddy currents will be proportional to $\omega\,\mathrm{B}/\mathrm{R}$, and the braking torque to $\omega\,\mathrm{B}^2/\mathrm{R}$, and since the driving torque is proportional to $\mathrm{B\,C}$, C being the current in the meter—

$$\omega = \mathrm{K\,C\,R/B},\ \mathrm{K}\text{ being a constant.}$$

If ω_0 and R_0 be the speed and resistance respectively at standard temperature, t the excess temperature of working over standard, α the resistance temperature coefficient of the material of the brake disk—

$$\omega = (1 + \alpha\,t)\,\mathrm{K\,C\,R_0/B} = \omega_0\,(1 + \alpha\,t),$$

and the temperature coefficient of the meter is equal to the resistance temperature coefficient of the material of the brake disk. In the majority of mercury meters of recent manufacture the armature disk serves also for braking, and it therefore follows that as copper disks are used in such meters, the temperature coefficient of these meters will be 0·428 per cent. per degree C. The above reasoning is based on the assumption that the whole of the line current passes through the armature disk. This is not strictly true, as actually the disk is shunted by the mercury. As the resistance temperature coefficient of mercury is 0·072 per cent. per degree C., the actual temperature coefficient of the meter will, for reasons dealt with below, be only about one-third per cent. per degree C.

The second case to be considered is that of a meter shunted with a material identical with that forming the meter circuit. In this case, calling the resistance of the meter and shunt circuits respectively r and r^1, the current in the meter will be $\mathrm{C}\,r/(r + r_1)$, and if r_0 and r_0^1 are the values of the resistances at standard temperature, the value of this current will be, β being the resistance temperature coefficient of the shunt and meter—

$$\mathrm{C}\,r_0^1\,(1 + \beta\,t)/(r_0 + r_0^1)\,(1 + \beta\,t) = \mathrm{C}\,r_0^1/(r_0 + r_0^1).$$

The ratio of the currents in the meter and shunt circuits is therefore independent of the temperature, and the temperature coefficient of the meter accordingly is not altered by the addition of a shunt of similar metal to that of the meter circuit.

If the meter is shunted by a special resistance metal, the expression for the current in the meter circuit will now be, calling the temperature coefficient of the shunt δ—

$$\mathrm{C}\,r_0^1\,(1 + \delta\,t)/\{r_0^1\,(1 + \delta\,t) + r_0\,(1 + \beta\,t)\}$$
$$= \mathrm{C}\,r^1/\{r^1 + r_0\,(1 + \beta\,t)\},$$

since δ will usually be so small as to be negligible. The equation of torques will now be—

$$\mathrm{C}\,r^1\,\mathrm{B}/\{r^1 + r_0\,(1 + \beta\,t)\} = \mathrm{K}\,\omega\,\mathrm{B}^2/\mathrm{R}_0\,(1 + \alpha\,t),$$
$$\omega = \mathrm{K\,C}\,r^1\,\mathrm{R}_0\,(1 + \alpha\,t)/\mathrm{B}\{r^1 + r_0\,(1 + \beta\,t)\}$$

$= \mathrm{K\,C\,R}_0(1 + \alpha\,t)/\mathrm{B}\{1 + n\,(1 + \beta\,t)\}$, where $r_0 = n\,r^1$; reducing finally, approximately, to—

$$\omega = \mathrm{K\,R_0/B} \times \mathrm{C}/(1 + n) \times \{1 + \alpha\,t - \beta\,t\,n/(n + 1)\}$$
$$= \omega_0\{1 + t\,(\alpha - \beta\,n/(n + 1)\}.$$

The temperature coefficient is accordingly $\alpha - \beta\,n/(n + 1)$. The great advantage to be gained by shunting a meter with a metal of approximately zero temperature coefficient is now apparent. If the bulk of the current is in the shunt—that is, if n be large—the temperature coefficient of the meter will be nearly the difference between α and β. This condition is usually satisfied in commutator meters. In such a meter, having an aluminium sheath for the armature coils to serve as a brake disk, the temperature coefficient of the meter will be nearly 0·43—0·42, or about 0·01 per cent. per degree C. It will be noted that the above reasoning does not take into account the back E.M.F. of the meter armature. Since the effect of this back E.M.F. is to increase the apparent resistance of the armature, and consequently to increase n, $\alpha - \beta$ will be a still closer approximation to the temperature coefficient of the meter.

The equation of torque for an unshunted watt-hour-meter will be, neglecting compensation for friction—

$$\mathrm{C\,V}/r = \mathrm{K\,B}^2\,\omega/\mathrm{R},$$

r being the resistance of the pressure coils and armature. If γ be the average resistance temperature coefficient of this circuit—

$$\omega = \omega_0\,(1 + \alpha\,t)/(1 + \gamma\,t) = \omega_0\,\{1 + (\alpha - \gamma)\,t\},$$

the temperature coefficient of the meter accordingly being $\alpha - \gamma$.

The cases of shunted watt-hour-meters and of Aron clock meters present a greater number of variable factors. The problem of temperature effect in such meters is too complicated to be investigated profitably. It may be said, however, that in such meters the elimination of temperature effect should be more feasible than in the simpler types, owing to the greater number of available adjustments.

The high temperature coefficient is a serious defect of the small mercury meter. There seems no simple way in which it can be reduced, judging from the fact that no such device has been placed on the market. Till this problem, however, is solved, the commutator meter will retain a very important advantage over the small mercury meter, in that the temperature coefficient of the former meter can be made as small as may be desired.

PROBLEMS OF INDUSTRY.

(Concluded from page 149.)

Recently Sir Herbert Austin delivered an address on Works Costs at a meeting of the Birmingham branch of the National Union of Manufacturers. According to a summary of the address appearing in the *Birmingham Daily Post*, the speaker said that post-war conditions would be much more stringent than any experienced for many years: Labour would demand a higher minimum wage, Capital would ask for a higher rate of interest, credits would be more expensive in every way, and in the big disorganisation that Peace would bring, the subject of works costs must receive serious and prompt attention. They would not have any time or opportunity to experiment, to dally with policy, or show any indecision.

To enable a manufacturer or contractor to enter confidently into an undertaking involving large sums of money, or commitments of various kinds, he must be sure of his ground, and it was here he wished to make his chief point—viz., working to a standard or predetermined cost. To firms engaged on contracting ahead for long periods or for seasons' sales, where the product was of a variable character, he counselled that the cost department should be prepared to lay down what were to be the costs and profits, before the work was commenced, or even the order accepted. and then every day to check and assure itself that the agreed or standardised costs were not exceeded. It might not be very easy in some businesses to carry out this scheme. and it would necessitate, in most cases, the provision of larger and more expensive staffs, but the confidence it gave, when properly installed. and the increased efficiency it ensured in all departments, would repay the cost a hundredfold.

The war, among other things, had brought them into a frame of mind by which they regarded combinations and associations of manufacturers in a more favourable light than before, and they realised more fully that an inefficient, badly-managed firm or undertaking in their own line of business was a source of danger to themselves and the community at large. Therefore, it should be possible in the future for anyone requiring assistance in an organising direction to appeal to the members of his association or federation to help him, with the knowledge that he would receive sympathetic treatment.

In regard to wages, for some years before the outbreak of the war there was a great deal of agitation against payment by results, and even in cases where men were employed on piece work, or bonus systems, it was a recognised rule to hold back production to prevent anyone earning more than, say, time-and-a-quarter to time-and-a-half. Obviously, the efficiency of the shop was lowered, and the indirect result was to hold back also the work done by the day workers—in other words, a general lowering down to one agreed level of production. If they were to succeed in the effort that all serious thinkers considered imperative, then they must change this levelling down of the efforts of labour. It must be graded, and the most skilful and diligent given the opportunity to increase their productiveness. It was just as necessary to grade the labour of the country as it was to grade for military service—the best must be put at the top, and the others assisted and offered inducements to make themselves more efficient and valuable. A rising scale of rates of minimum standard pay would be required, and different piece-work prices, with an efficiency bonus for both day and piece workers who exceeded an agreed standard of output. To carry out such a change it was manifest that the works cost office might need to be strengthened to cope with the additional work, and a definite method installed of obtaining and recording proper standards of efficiency.

Speaking at the Birmingham Rotary Club on "Problems of Industrial Manufacture," Mr. Arthur Cox said that there was in reality one supreme problem—that of industrial organisation.

The complete set of problems was of colossal dimensions, but they had to be solved. Labour was getting better and better organised, and employers of labour would have to be better organised—and soon. National success depended upon the amount of harmony existing between the two organised bodies; national failure and disaster were inevitable if the two bodies were to be antagonistic. Labour wanted the assurance of a good living wage; better conditions of living; more say in the conduct of businesses; better provision for sickness and old age. The employers wanted the assurance of being able to secure a fair and reasonable return on their invested capital; the removal of all restrictions on output; full scope and recompense for initiative and enterprise. The nation would need the highest possible productive efficiency for many years following the cessation of hostilities. But to get this result there was one thing essential. The peculiar psychology of the British working man must be studied. The more the working man was really understood, the easier it would be to straighten things out. Wage payments must be based upon results in such manner as to form true profit-sharing systems which the working man could easily understand.

According to the *Birmingham Daily Post*, Mr. Cox said that the Whitley Report had sketched out a good general idea for an above-ground plan for a building proposed to be erected. The new foundation must be composed of the old granite blocks of good fellowship, but a new formula must be found for the cement which binds them together. They wanted a formula for what was a full day's work for a full day's pay. The formula for determining it must be very simple. It must take into account at all times the market value of the goods produced, and that there must be a considerable margin between cost and the selling price if provision is to be made for superannuation, and for full pay for holidays and during sickness.

Mr. J. Percy Plant said that there were difficulties when firms came to carry out the recommendations of the Whitley Report. His firm had attempted to do this, and they had found that the election of a Works Committee by ballot did not tend to produce the men who were really representative of the various sections of the works. That was an element of weakness.

The *Labour Gazette* for February contains the full statement of objects and constitution of the National Council which has been formed in the Pottery Industry, and as this is the first Whitley Council to be formed, we refer our readers to the *Gazette* for the details of the constitution. Space only permits us to publish the objects with which it has been set up, but we recommend these for consideration by the electrical and engineering industries :—

The advancement of the Pottery Industry and of all connected with it by the Association in its government of all engaged in the industry.

It will be open to the Council to take any action that falls within the scope of its general object. Its chief work will, however, fall under the following heads :—

(*a*) The consideration of means whereby all manufacturers and operatives shall be brought within their respective Associations.

(*b*) Regular consideration of wages, piece-work prices, and conditions, with a view to establishing and maintaining equitable conditions throughout the industry.

(*c*) To assist the respective Associations in the maintenance of such selling prices as will afford a reasonable remuneration to both employers and employed.

(*d*) The consideration and settlement of all disputes between different parties in the industry which it may not have been possible to settle by the existing machinery, and the establishment of machinery for dealing with disputes where adequate machinery does not exist.

(*e*) The regularisation of production and employment as a means of insuring to the workpeople the greatest possible security of earnings.

(*f*) Improvement in conditions with a view to removing all danger to health in the industry.

(*g*) The study of processes, the encouragement of research, and the full utilisation of their results.

(*h*) The provision of facilities for the full consideration and utilisation of inventions and improvements designed by workpeople and for the adequate safeguarding of the rights of the designers of such improvements.

(*i*) Education in all its branches for the industry.

(*j*) The collection of full statistics on wages, making and selling prices, and average percentages of profits on turnover, and on materials, markets, costs, &c., and the study and promotion of scientific and practical systems of costing to this end.

All statistics shall, where necessary, be verified by chartered accountants, who shall make a statutory declaration as to secrecy prior to any investigation, and no particulars of individual firms or operatives shall be disclosed to anyone.

(*k*) Inquiries into problems of the industry, and where desirable, the publication of reports.

(*l*) Representation of the needs and opinions of the industry to Government authorities, central and local, and to the community generally.

GREAT BRITAIN'S INTEREST IN THE METRIC SYSTEM OF WEIGHTS AND MEASURES.

By HARRY ALLCOCK.

1. When the war is over it must be paid for. The burden of post-war taxation can only be lightened by increased production, and by the sale of these excess products to overseas consumers.

2. Provided always that the menace of a conflict between Capital and Labour is removed without reverting to "restriction of output," and that adequate supplies of raw materials and cheap power are assured, we shall find ourselves at the end of the war with enormously increased resources for cheap production as compared with our pre-war position. The capacity of our industries to absorb the labour of our demobilised fighting forces will thus depend mainly upon our ability to increase the demand for our goods.

3. Unfortunately, our sales organisations have necessarily been neglected during the war period, and, in addition to the fact that other countries have not failed to profit by our temporary inability to execute overseas orders, we must bear in mind that post-war economic pressure will intensify the international struggle for commercial supremacy.

4. We shall accordingly find ourselves confronted by unusually keen competition abroad at a time when the national interest demands an enormous expansion of our overseas trade. It will thus be just as necessary for us to organise our export trade as it was for us to organise, for instance, the manufacture of shells and other war munitions.

5. This necessary organisation and development of our export trade will demand the elimination of all hampering influences. In this connection it will then be remembered that for years past our overseas representatives—both Government and private—have urged the importance of our more extensive use of the international metric system of weights and measures which so many of our present and potential overseas customers already employ. (The use of the metric system is obligatory in 34 countries, representing a population of over 437 millions, and optional in a further eleven countries having a population of over 727 million people.)

6. Whether we like it or not, we already find ourselves compelled to use the metric system for a portion of our trade and to an ever-increasing extent. The retention of our own British system thus compels us to handicap ourselves by working in two systems where one would suffice. For the reassurance of those who, having no intimate knowledge of the metric system, feel some alarm at the suggested abandonment of the British system in its favour, the following statement by the Right Hon. A. J. Balfour, M.P., may be quoted. Replying to a deputation in 1895 he said :—

> "Upon the merits of the case, I think there can be no doubt whatever that the judgment of the whole civilised world, not excluding countries which still adhere to the antiquated systems under which we suffer, has long decided that the metric system is the only rational system."

7. Germany employs one system—the metric system—throughout her laboratories, workshops, home trade, and foreign trade. Britain employs the metric system in her laboratories, the British system and the metric system in her workshops, the British system for our home trade and the metric system for part of her export trade. (Our Colonies have already signified their desire to adopt the metric system simultaneously with the Mother Country.)

8. When we realise that our national existence depends upon our ability to sell British manufactured goods to all nations, *i.e.*, to develop a world-wide trade, it will be apparent that Great Britain, more than any other country, would benefit from the establishment of a universal system of weights and measures. It will be obvious

that our adoption of the metric system would establish it as the universal language of quantity, but, on the other hand, it is equally clear that the British system could never become the universal system, because of its inherent defects. In the early seventies Germany adopted what was then known as the French metric system, notwithstanding the anti-French sentiments then existing on account of the Franco-Prussian war. Since that date the use of the system has been extended to 24 additional countries, and it is now truly described as the international metric system. These facts should be borne in mind by those who may be inclined to consider that our adoption of the metric system would benefit Germany more than ourselves.

9. At the end of the war British manufacturers will not merely revert to their pre-war standard products—new designs and new methods will be the order of the day, and a unique opportunity is thus presented for the reorganisation of British firms on the metric basis. If all sales were then compulsorily made in terms of the metric system, it would follow that all new designs, patterns, &c., would be prepared on the metric basis, but the old patterns, &c., could be continued in use for manufacturing purposes until they became worn out or obsolete. In selling the products of these old British-dimensioned patterns, &c., all dimensions in tenders, invoices, &c., would be given in metric equivalents, just as we do to-day in our export departments. With the passage of time such conversions would naturally decrease in volume, and finally disappear, whereas, under existing circumstances, they must increase continuously.

10. In some cases where the coincident use of the British and metric systems during a transition period could be shown to be especially inconvenient, it would not be unreasonable for the Government to bear the cost of the change by, for instance, allowing the firms in question to retain out of the amount they would otherwise pay in excess war profits a sufficient sum to enable them to replace their present stocks of British-dimensioned patterns, &c., by new metric patterns, &c. Any costs so borne by the nation as a whole would be speedily reimbursed to the taxpayer through the medium of the reduced taxation rendered possible by the consequent expansion of our export trade and its attendant benefits.

The value of the collateral advantages accruing to the entire community from our adoption of the metric system (*e.g.*, the economies of time and labour in education, in calculations involving quantities and dimensions, in communications between the scientists, the producers, and the consumers of the world) cannot be expressed in money, but it would be admittedly very great.

It should also be remembered that the longer our adoption of this inevitable reform is deferred, the greater will be the magnitude and extent of the incidental difficulties to be overcome.

SWITCHGEAR STANDARDISATION.

By CHARLES C. GARRARD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Of all departments of electrical engineering, switchgear is perhaps the one whose development is in the greatest state of flux, and in which more changes and improvements are continually taking place, and will continue to take place, than in any other. Under these circumstances, at first sight, it may be thought that it is a very unfit subject for standardisation. Such a conclusion, however, betrays a want of appreciation of the true and best meaning of standardisation. Standardisation properly understood is essentially a co-operative action on the part of the designers and manufacturers concerned in order that the best product may be produced in the shortest time, and with the least expenditure. To attain this end each party throws into the common stock his knowledge and experience; the old-fashioned secretive policy is abandoned, it being recognised that in this, as in so many other departments of national life, the purely individualistic policy must give way to the more enlightened and, in the long run, better-paying one of mutual help and combined action.

Apart, however, from the need of such a change in our methods, if we are to maintain our position in the world's engineering market in the future, it must be recognised that it is also necessary if we are even to put ourselves upon an equality with other countries. Switchgear standardisation has already had considerable attention paid to it in America, Switzerland, and Germany, and one object in view in submitting this paper is to call attention to this fact, and to urge that such steps be taken as will put an end to this unsatisfactory state of affairs.

The authority for engineering standardisation in this country is the Engineering Standards Committee. According to the 1917 report of the Committee no single standard specification dealing with any form of switchgear has been issued. In fact, there does not seem to be any suitable organisation within the Standards Committee to deal with such work. It would appear that there is urgent need for the formation of a special sub-committee to deal specifically with switch and controlling gear.

A standard test pressure should be agreed upon applicable to all switch and controlling gear. This should be higher than the corresponding test for machinery. The American Standardisation Rule No. 500 specifies for machinery a test pressure equal to 1,000 volts plus twice the normal; for switches and control apparatus above 600 volts, however, Rule No. 509 calls for 2,000 volts plus 2¼ times the rated voltage. This test is very good and reasonable, and, moreover, is a sufficiently high one for any form of switchgear. We cannot do better than adopt it.

The standardisation of copper has already received considerable attention from the Engineering Standards Committee, and a similar standardisation of the other current-carrying materials used in switchgear should be made. These include brass, gun-metal, and phosphor bronze. The whole subject of copper alloys stands in urgent need of standardisation. The percentage composition of a "brass" casting is, for example, a very nebulous quantity.

A standardisation of the length of break of knife switches, distance between the centre lines of the poles, sizes of terminals, current density in the material, and general style of construction is very necessary. At the present time various authorities have fixed their own standards, necessitating special manufacture. In addition, numbers of obsolete requirements are still insisted upon in certain quarters. For example, the condition that the hinge of a knife switch should not carry current still survives. This should be obviated in future. As regards the current density of surface contacts, it is not desirable to fix limits as to this, as apparently very high surface densities sometimes yield very good results. There is much to be said in favour of the type of switch contact illustrated in fig. 1. With the ordinary form of flat contact the current really only passed at a single or a few points. With the controller-finger type, however, a definite line contact is obtained. A standardisation of the millivolt drop at contacts would be a very good thing, and, as this is a direct measurement of the capability of the device to make contact, has much to recommend it. The values given in fig. 2 are founded on actual practice in good work.

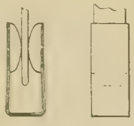

Fig. 1.—Controller-finger Type of Switch Contact.

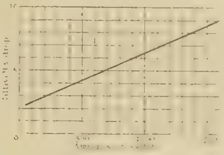

Fig. 2.—Millivolt Drop at the Jaws of Knife Switches.

Considerable variations exist at present in the practice of different manufacturers in regard to back connection studs, more especially as regards the screw threads adopted. The type of thread used must be determined more from considerations of electrical conductivity than from mechanical ones. The Whitworth screw threads, for example, on the larger sizes have too coarse a pitch, which cuts unduly into the cross-section of the rod. A standardisation of these screw threads, as also of the corresponding nuts, is very necessary. The particulars given in Table I have been found suitable by the author. It will be seen that with the exception of the smallest size the Whitworth form of thread has been adhered to. In all sizes, however, about ⅝ in. diameter the pitch is smaller than that of the corresponding diameter Whitworth standard screw. Above 3,000 amperes the form of construction illustrated in fig. 3 is to be preferred. Strip connections riveted and soldered into the switch block constitute a better electrical connection and, moreover, are cheaper to construct in these sizes than studs would be.

Table I.—Suggested Standards for Back Connection Studs for Switches, &c. Whitworth-Shaped Thread.

Current in amperes	Rod diam. in inches.	Screwing of stud.	Current in amps.	Rod diam. in inches.	Screwing of stud.
3,000	2	11 threads per in.	300	[illegible]	[illegible] in. Whitworth standard.
2,500	1¾	..			
2,000	1⅝	..	200	[illegible]	½ in. ..
1,800	1½	..	150	[illegible]	7/16 in. ,,
1,500	1⅜	..	100	[illegible]	⅜ in. ,,
1,200	1¼	..	75	[illegible]	5/16 in. ,,
1,000	1⅛	.	50	[illegible]	¼ in. ,,
800	1	..	25	0·184 to 0·186	No. 2 B.A.
600	⅞	..			
400	¾	..			

The nuts for making the connection between the studs and the connection strips must be thinner than standard Whitworth nuts. This is necessary in the [illegible] considerations of space which [illegible] at the back of switchboards. The chief [illegible] must be possible to [illegible] a neat [illegible] tions attached to the studs so arranged that they occupy the minimum of space consistent with efficient ventilation. The best arrangement is to make the spacing nuts double the thickness of the standard connection strip.

The nuts should be practically flat-sided, the corners only being slightly chamfered to prevent their cutting into the material of the strips.

The standardisation of oil switches is at the moment receiving attention, and will, therefore, not be discussed at great length here. The considerable amount of work which has taken place in other countries has had the result, before the war, of greatly assisting our foreign competitors' export trade in switchgear. The German manufacturer, for example, fortified with a set of carefully worked-out standards, was at a great advantage as compared with the British manufacturer, who had nothing similar to put forward.

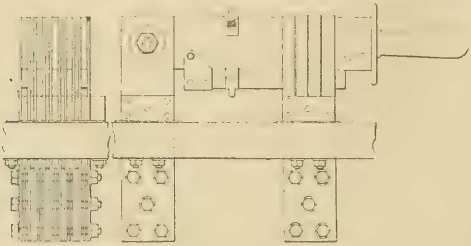

Fig. 3.—Large Knife Switch with Strip Back Connections.

The German, or "V.D.E.," rules referred to not only include a set of standards as regards the construction of the switches themselves, but also a number of suggestions to guide the operating engineer in his selection of a suitable switch having regard to the possible value of the short-circuit current at the situation where the switch is to be used. Such a set of rules is of the utmost service.

The most important point in switch standardisation is their rating in terms of breaking capacity. Such a rating can only be reliable if based upon actual experience. Systematic tests are necessary if progress is to be made in a reasonable time. Recently, and since the war, the Allgemeine Electricitäts Gesellschaft of Berlin has built a special laboratory for the specific purpose of testing oil switches.

It is improbable that any single concern will go to the great expense of establishing and running a research laboratory on the necessary large scale. This would be much better dealt with by co-operative action between the industry as a whole and the Government. This action could take the form of the establishment of a national high-tension research and standardising laboratory, which could deal with such problems as this and those mentioned under the heading of lightning arresters. The equipment, staffing, and running of an efficient laboratory on the necessary scale mean something altogether different from anything yet attempted in this country. The very best engineering talent should be secured for its direction, and considerable financial resources would have to be available for the large-scale experiments necessary.

The leading consideration to be borne in mind when installing an oil switch on a large system is the maximum power in kilovolt-amperes which it will have to rupture. The use of reactances to limit the short-circuit current has now become recognised as essential for continuity of supply. It is suggested that a maximum breaking capacity of 500,000 K.V.A. should be regarded, at present, as the largest short-circuit load with which any oil switch should be called upon to deal. This is considerably larger than any of the standards set up by the V.D.E., and would therefore constitute a considerable advantage over those rules.

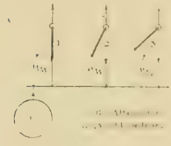

Fig. 4.

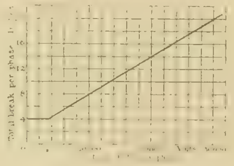

Fig. 5.

Fig. 4.—Diagram Illustrating the use of Two-step Oil Switches having Resistances, or Choking Coils, connected between the Steps.

Fig. 5.—Curve Connecting Total Length of Break and Voltage of Oil Switches.

The use of the two-step oil switch (fig. 4) having a resistance or choking coil connected between the two steps has been [illegible] The Swiss Electrotechnical [illegible] With such a switch, on switching in the resistance is momentarily connected in series with the circuit, and then short-circuited. On switching off the order of procedure is reversed.

The use of the charging resistance is of value in the case of switching-in large transformers, for preventing the abnormal rush of current which sometimes occurs. Such a current, however, lasts only for a very short time, and the only real trouble is due to the tripping of the overload release gear. This can be guarded against by a time lag on the transformer switch. For switching-in cables such double-contact switches are totally unnecessary.

Such charging resistances are also sometimes used for switching-in large motors, the object being to prevent the concentration of voltage across the end turns of the windings and consequent danger of internal short-circuit. For this purpose a non-inductive resistance is not much good, but a charging choke coil should be used. A method such as this is simply a condonation of inferior insulation of the machine concerned. If this latter were properly constructed, such special switching appliances should not be necessary.

The Swiss Electrotechnical Society base their recommendation of the use of such double-contact switches on their alleged capability of dealing with heavier short-circuits than single-contact switches. It is very much to be doubted whether this contention is right, and in the absence of reliable test results, made under the heaviest conditions, it should not be accepted.

It is possible, by means of special constructions, to shorten considerably the length of break necessary in an oil switch.

It is better to have such a length of break that a reasonable degree of safety is secured, even if the special devices mentioned are put out of action. By length of break is meant the total length; thus if there are two breaks per phase it is the sum of the two breaks. Fig. 5 represents the average of a number of first-class modern manufacturers, and may be taken as typical of present-day designs. For switches of exceptionally large breaking capacity, however, the breaks are sometimes larger than those indicated in the curve.

In all cases, for switches of any considerable size, insulating barriers should be arranged between the phases. The question whether a separate oil tank should be used per phase is simply one of size and weight. On the larger switches a single tank becomes too unwieldy to handle. For great breaking capacities, therefore, three tanks are used, and with such switches it is better to arrange for actual concrete or brick barriers to separate the phases entirely.

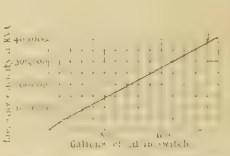

Fig. 6.—Curve Connecting Quantity of Oil and Breaking Capacity of Oil Circuit-breakers.

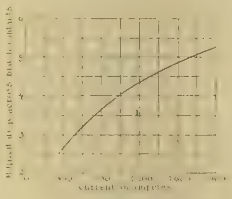

Fig. 7.—Millivolt Drop Across Brush Contacts.

As the oil is the medium for taking up the energy liberated within the switch at the instant of rupture, it is to be assumed that the more oil there is the greater the breaking capacity, provided, of course, that the whole of the oil is brought into effective use. Much larger oil tanks than were previously used are now common. The curve in fig. 6 connects the total quantity of oil and maximum K.V.A. breaking capacity, and may be taken as representing good modern practice.

A high speed of operation is now recognised as an important factor in increasing the breaking capacity. It is of the utmost importance that the current be finally ruptured during as small a proportion of the total travel as possible. It must be borne in mind that if there are two breaks per phase, the circuit is being actually opened at twice the speed of the mechanism.

In circuit breakers, brush contacts are usually used at a very considerably higher contact surface-density than the jaws of knife switches. A separate standard of specific pressure drop of brush contacts is therefore required. The values given in fig. 7 represent results which can be obtained by reasonably good work, and which do not result in temperature rise above those suggested later.

(*To be concluded.*)

Discussion in London.

The **President**, Mr. C. H. **Wordingham**, said the author gave them many practical suggestions. There were one or two matters to which reference might be made: he was glad to see that the author recognised the Engineering Standards Committee as *the* authority on standardisation in this country. It was so in fact, and all engineering authorities should support it. A conference had been held last year with the B.E.A.M.A., at which Mr. Hobart represented American interests, and it was agreed that the switch standardisation should be taken up with American co-operation. They were about to set up a strong committee which would deal with the matters referred to by the author in the near future. A standard specification was about to be issued for the face-plate type of motor starter, which was the most widely used. He agreed as to the necessity for investigation in switch design, but felt it would be better to use existing institutions rather than to start new ones; he was hopeful that the Standards Committee would be able to call on the Institution for help, and that the latter would induce the Local Sections to assist by sub-dividing the work amongst them. Standardisation was a thorny question; it was largely a question of reconciling conflicting interests, and it was hopeless to put forward standards which might be good for the user unless they were acceptable to the manufacturer also.

Captain A. M. **Taylor** said he was personally interested in oil switches, in regard to which acquaintance with one or two serious burn-outs had impressed him with the necessity for reliable construction. At Birmingham they had endeavoured to use switches suited to the maximum short-circuit current at the point of use; he quite agreed with the necessity of sectionalising bus-bars, but some diversity of opinion existed on the question. The two-step switches would be very useful under some conditions. It was misleading to consider breaking capacity in relation to head of oil over contacts, as this was unjust to some designs where the best possible use was made of the oil. The quantity of oil was a factor when a conflagration took place; in some cases many hours elapsed before the switch could be touched.

Mr. E. W. **Cowan** said he agreed almost wholly with the author. He suggested, however, that it would be an advantage to specify red-metal for castings in addition to brass and gunmetal. Red-metal should take the place of cast copper. Too much attention was paid to area of contact in switches, and too little to points of contact; he agreed as to the value of the millivolt method of standardising drop across switch-contacts. In oil switches, the head of oil was the important thing; he described a method of quenching the incandescent vapour arising from the break, which had been used in the Transvaal systems. He agreed that standardisation was very necessary, and the industry must assist in it.

Mr. H. H. **Berry** said the paper gave them excellent material for future deliberation in connection with standardisation. The primary matters were standardisation and a proving-house to prove the designs, &c. He warned them not to adopt the same method as the United States, where the manufacturers whose material was tested supplied the funds; there apparatus had been standardised to the exclusion of much simpler apparatus to do the same work. Here we must endeavour to standardise the simplest form of apparatus which could be made interchangeable; in America better apparatus was thrown out on its demerits in regard to non-interchangeability.

Mr. E. T. **Williams** was convinced that if they wanted to compete for business in the future, they must take up standardisation in a thorough way. The primary intention in standardisation was not in reference to replacements, but rather the avoiding of a multiplicity of articles where one or two would suffice. They must not stifle invention or new development. He knew that there was a pronounced feeling that if anything new required taking up they had to go to the Americans or, before the war, to the Germans. They must give consideration to new ideas.

Mr. **Gott** said they needed a clear definition of the scope of standardisation. He did not attach much importance to the author's specification for castings, as a little impurity had a great effect on conductivity. Something could be said, in the case of large switches, for clamping the switch after making contact. The smaller size threads suggested for switch connections, &c., were too small for mechanical reasons, and there were far too many sizes on the list. He agreed as to the utility of two-step switches, and had no sympathy with the interruption of large currents disruptively.

Prof. **Morris** agreed with the views expressed on standardisation. He suggested that certain alloys were worth considering to take the place of materials now used in switch work; rolled aluminium, for instance, should be included in the list. He agreed that contact efficiency was far more important than contact area, and suggested that in oil switches a series of oil jets issuing through perforations in the contact surfaces would be far more efficient than simple tank immersion. As copper fuses blew very much quicker than lead fuses, it was possible to grade fuses so that they would blow in the right order.

Mr. A. H. **Ellis** said that nothing less than ⅜ in. diameter studs should be used in switch work. It was an erroneous impression that oil-switch tanks rarely blew off; such tanks should be of boiler plate, with suitable vents, and very pure oil should be used. It was a question whether it was not better to use a multiple break rather than to increase the length of opening; he disagreed with the length of break for oil switches given by the author. A great quantity of oil was not necessary. Fuses should be tested under the worst conditions at the station; if they were safe there, they would be safe [illegible].

Mr W T **T**[illegible] agreed [illegible] standardising, though [illegible] the position of the [illegible] oil switch makers there could be [illegible]. Absolute similarity of manufacture was not necessary, as each works would require its own patterns, tools, &c. Standardisation was necessary in cases where other people's material was affected, but he could not agree that it was suited to oil switchgear. He suggested that temperature rise should be the measure of carrying capacity in switches.

Dr. **Garrard** briefly replied to the discussion, and the meeting closed.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Comparative Costs of Steam and Electric Drive.

A certain factory uses steam for manufacturing and driving. It is desired to compare costs for steam and electrical driving. What are the most essential points to prove which is the cheaper to run? Labour can be taken at pre-war rates, and coal at 10s. a ton. The load, 500 H.P., which is fairly compact, is working full on 10 hours a day for five days, and five hours Saturday. The Lancashire boilers are near the engine, and one is used specially for the driving. It is understood that the consumer pays for 500 yd. cable, 440-volt D.C., to couple up to Corporation mains. Three schemes can be taken:—(1) One large motor, 500 H.P.; (2) five motors, 100 H.P. each; (3) 20 motors, 30 H.P. each.

Steam.

Electric Power Supply in Great Britain.

The interim report of the Coal Conservation Sub-Committee, which was released about two months ago, has so far evoked very little serious criticism, and whilst I realise that perhaps it is not advisable for the opponents of the report to be in a hurry to disclose their side of the case, yet I feel that it is time that some of the one-sided statements should be challenged, and I venture to offer the following comments in the hope that others will take up the matter, and not allow those unacquainted with the details to swallow the report as being the one and only cure for the health of our electric power supply.

One cannot help noting at the outset that the report is dated April 16th, 1917, and the fact that it has been kept secret so long, when such vital interests were at issue, immediately raises suspicion. I have read the report several times, and fail to find anything in it that can be said to "assist the enemy"—unless such enemy be the municipalities, and the tone of the report suggests this.

Suspicion is deepened still more when we see the way in which the Board of Trade endeavoured to ignore the municipalities in the composition of the Committee it appointed to report on the Electric Supply of Great Britain.

I feel it is up to the municipalities, through the I.M.E.A., to issue a counter-report, seeing that the Coal Conservation Sub-Committee, which is without a municipal representative, has so vigorously attacked municipal ownership.

Now a few remarks on the report itself:—

A great effort is made to show a "total *possible* national advantage of £100,000,000 per annum." Note carefully the wording—a "possible national advantage." No word as to the net financial result.

The report is noteworthy in its silence as to the cost of establishing all the super-stations and trunk roads to obtain the national advantage referred to. Not a single figure is given as to the capital cost that will be involved, or the ultimate price at which one may expect to purchase the power; these and many other vital financial points are conveniently ignored.

Some enlightenment, however, is vouchsafed in Appendix D, page 26. It is there stated in regard to the North-East Coast operations, that "its development and the growth of its profit-earning capacity were considerably delayed by the work which had to be done from time to time, and the sacrifices that had to be made to secure uniformity of system." If this has been the case in one district, what will be involved for the whole of Great Britain? The location of some of the largest existing power stations is criticised, but here, again, not the slightest indication is given that suitable sites are obtainable which will embrace the three essentials, viz.:—(1) An ample supply of water, (2) close proximity to coalfields to effect saving in transport, (3) to be within reasonable distances of the districts to be supplied.

The Newcastle district is held up as a pattern for the rest of Great Britain, but, of course, no more ideal district could be found for such a scheme, and this is admitted in Appendix D, on page 26 of the Report, where it is stated that in coal, iron, and shipbuilding the North-East Coast figures represent respectively and approximately one-fifth, one-third, and half of the nation's output.

Again, the prices charged on the North-East Coast are compared with the Lancashire area. Here, of course, is the [illegible] and the usual [illegible] the [illegible].

I venture to say that if the prices charged to individual consumers on the North-East Coast be compared with those of municipalities where the consumers take equal quantities of power under similar conditions, there will not be found to be that large difference which the report suggests, particularly bearing in mind that the municipalities pay a fixed interest on their capital, and also make definite repayments of capital each year.

Great stress is laid upon the necessity of one large controlling body of private interests for the electric supply, and comparison is made with the railways, but there is this immense difference—under the proposals for the electric power supply there would be an absolute monopoly, but this has not been the case hitherto with the railways; for instance, a passenger from London to Edinburgh had the option of not less than three routes, and each company did their best to make that particular route the most attractive.

We have heard a great deal lately of the soullessness of the War Office, and one knows, to their sorrow, what Government control means in business, and many examples could be quoted of the deterioration of public services once they have become merged into one immense individually-controlled concern, such as is now proposed for the electric power supply of Great Britain—soulless is, I think, the best description.

As against these examples, let us consider the tramway systems of Great Britain. Can it be said that the Liverpool, Manchester, Leeds, Birmingham, Sheffield, and Glasgow (to quote a few) systems are examples of municipal mismanagement, and can any company-managed undertakings show better results than these? Similarly with electric power supply, it has yet to be *proved* that private ownership and management is better than a municipal one.

The fetish of super-stations, I know, is the reply, but such reply can only be accepted if backed up with definite proof that the change is going to be a sound one, not only nationally, but financially, unless, of course, the nation is prepared to pay for the advantage it will obtain in the calculated conservation of its coal supply. It is monstrous to suggest that an individual must pay more for his electricity in order to benefit the nation by conserving the coal supply.

The aspect of the question from the electric supply legislation point of view is laboured at great length, and here, again, the municipalities come under the whip. It is well known that the desire of the power companies was to traverse all districts and scoop up the large and remunerative consumers, leaving the small and unremunerative ones to the municipality, and this idea is still running in their minds, as on page 16, paragraph 40, also page 14 of the report, they suggest that the new authority take over all existing undertakings and systems, except "possibly the lighting and small power consumers."

Here in a nutshell is the answer to the insinuations made against municipalities in the second paragraph of the footnote on page 13, and indirectly hinted at in Appendix B.

It is not that they (municipalities) have under-charged power consumers and over-charged for other services. If anything, the reverse is the case, and innumerable instances could be quoted to show that the sale of power at low prices has enabled the charge for other services to be reduced. It is the small consumer that is a drag on an undertaking, unless there is a preponderance of large consumers to make the small ones a negligible quantity, and that is why the report suggests that the new authority take over the large remunerative supplies, leaving the small and unremunerative ones to local bodies.

Whilst the legislative difficulties of power companies are emphasised, nothing is said about similar difficulties that municipalities experience. They are bound to accept all consumers, large or small, and treat all alike, and they are always jealously watched by gas authorities and others to see that they do not exceed their legal powers (the recent Hackney case is a notable example).

Very few undertakings have power to hire apparatus or carry out any installation work, all extensions to the plant and mains have to receive the solemn sanction, after due inquiry, of the L.G.B., and the annual interest and repayment of loans have to be rigidly adhered to.

The municipality is bound to the four corners of its provisional order area, and any new business, although a sound commercial proposition, is out of the question if there is the slightest suggestion of preferential charges. Give the municipalities the same power as it is proposed to give to the new electric supply authority, and there is no doubt that the same saving in coal will be realised at a far less capital outlay.

It is amusing to see the pretty little fable at the foot of page 11 resuscitated in a serious Government report. Doubtless the author of it imagined himself to be the only man in London, probably the super-man. He appears to have quite overlooked the fact that the station supplying his office light may equally cook another man's breakfast and supply the power for a third man's train. A proposal which has to resort to such arguments for its backing must evidently be a very thin one.

It is also very pathetic to see the feeble attempt made on page 15 of the report to obtain the support of the Labour Party by dangling before their eyes the idea of a universal supply of cheap electricity. Perhaps the authors of the report could enlighten us as to how far this has been realised in all the workmen's houses in that "clean-cut example" of the North-East Coast.

In conclusion, I would say that it behoves every municipal engineer to carefully study the report, and see that *both* sides of the question are fully laid before their respective Members of Parliament, as that is the most effective method of counteracting the attempt that is being made to take advantage of war conditions to hustle the nation into handing over our electric power supply to the soullessness of company ownership, whose incentive (according to Appendix C, paragraph E) is "bigger profits," or, to put it tersely, coal conservation is mere camouflage for the creation of a huge private monopoly of our electric power supply.

Fredk. W. Purse,
City Electrical Engineer.

Carlisle, *February 22nd*, 1918.

P.S.—The above was written before the statement of the I.M.E.A. appeared. To be correct, of course, it should be "statement of the I.M.E.A. Council." The comment by the Hon. Secretary that the views set forth may not be agreeable to many of the smaller undertakings is especially noteworthy when one remembers the long struggle to obtain a more adequate representation of such undertakings on the Council. It will be interesting to watch how the opinions of the "lesser fry" will be considered and respected.—F.W.P.

The 12½ per cent. Award and Clerical Staffs.

The letter published by you in your issue of February 18th, from "Chief Clerk," is a timely one, as, without doubt, there exists a great diversity of opinion as to whether clerical staffs were meant to come within the scope of the award, and it is this lack of definiteness, unfortunately common to many of the orders, &c., issued by official departments, which no doubt prevents many chief engineers and electric supply committees from coming to any decision upon the matter. In some instances, however, it provides the proverbial loophole for "driving a carriage and pair through the Act," and consequently there are bound to be instances of employés being excluded who cannot enforce their claim due to this lack of clearness of definition.

It cannot but be admitted, however, that without the assistance and loyal co-operation of the commercial and clerical staffs electricity undertakings could not be efficiently worked, and it is, therefore, difficult to conceive that Sir George Askwith had the intention of excluding them from his award of January 7th. It would settle what is at present a great grievance if it were possible for Mr. Proctor, in his capacity of Secretary to the I.M.E.A., to obtain a definite official ruling upon this point for the guidance and instruction of all concerned, and would, further, ensure uniformity of treatment, which at present does not exist. Incidentally, this would also avoid the necessity for the usual stereotyped inquiry being sent round to ascertain what other undertakings were doing, and consider the saving of time and paper, &c., it would mean in not requiring to comply with the usual request for "a copy of the tabulated replies received"!

In connection with the definition of the term "technical staff" referred to in the award, may I be allowed to put the following query:—

How many clerks are there who have *not* been granted the 12½ per cent. bonus, but who *have* been claimed by their chiefs in the return on Form MM.82.S. as coming under Code Nos. 2,015 and 2,017 of the Schedule of Protected Occupations, the latter of which provides protection (above a certain age limit) for "*technical staff and clerks possessing high technical knowledge*"?

I am afraid the definition of "technical staff" is not, in many cases, the same now as in May, 1917.

Diversity Factor.

I have been much interested in the correspondence in your columns from "Chief Clerk" and "Another Chief Clerk" regarding the 12½ per cent. award. I conclude these gentlemen are in a similar position to myself, and have been refused the bonus as being in a class who are not covered by the award.

It seems to me to be hopeless to await some voluntary official ruling on this point, and even if there is a remote possibility of such an occurrence, is there not some department or power to which we could independently refer our cases, and ask for a decision? Perhaps you can enlighten us on this matter.

Inquirer.

[As we have already indicated, the proper course, when a difference *has arisen* regarding the applicability of the award, is to appeal to the Chief Commissioner.—Eds. Elec. Rev.]

The Organisation of Electric Supply Officials.

The correspondence and other columns of the electrical papers show that organisation is in the air, but I have not seen any public suggestion of the need of an Association comprising officials on the commercial side of the electric supply industry.

Such a proposal is, however, bound to come, and I venture to submit for discussion the question whether it is more to the advantage of all concerned that separate associations should be formed for different classes of officials, or that all should combine in one organisation for mutual protection and the advancement of the industry.

There is, I think, some danger of jealousy and hostility being created between different classes of officials by the setting up of exclusive organisations, and such a state of things is not likely to redound to the advantage of the individuals, or the efficient working of the undertakings concerned. The expected developments in national electricity supply may give rise to many questions involving the interests of both engineering and commercial staffs of existing undertakings, and each class could bring to a combined organisation some help in defending those legitimate interests. But I do not propose to argue the question at this stage. My object is to arouse discussion by others.

G.

February 20th, 1918.

WAR ITEMS.

Exports to China. The *London Gazette* for February 26th contains names of further persons and bodies in China to whom exports may be consigned.

A German Industrial Council.—The Amsterdam correspondent of the *Morning Post* quotes the *Lokalanzeiger* to the effect that a German Industrial Council has been founded in Berlin consisting of 25 representatives of the Union of Manufacturers, 25 representatives of the Central Association of German Manufacturers, and four representatives of the Association for the Protection of the Interests of the Chemical Industry.

Raw Material Stocks for Peace Manufacturing.—Dr. Addison has appointed a Committee to consider an important question affecting after-war industry. It is entitled "The Committee on Financial Risks Attaching to the Holding of Trading Stocks," and consists of representatives of Government Departments, banking, merchants and manufacturers. Trade Unions, and others. Its duty is thus described :--

"To inquire and to report as to any measures which could be adopted with a view to securing that manufacturers should be financially in a position to hold stocks after the war, and that reasonable safeguards are established to prevent serious financial losses as a result of possible depression following on a period of great inflation in respect of stocks of materials required for industry."

It is understood that as the prices of materials are greatly inflated at present, manufacturers are disinclined to purchase stocks in readiness for the resumption of full peace-time production, as they are in fear of a big fall when Peace comes, and they will be involved in loss. Dr. Addison has been informed that they are limiting themselves to quantities which will barely tide them over contracts to which they are already committed, and deferring the purchase of materials for making articles for stocks. The Committee is appointed because the above action will probably retard the return to maximum national productiveness, and it will investigate the matter with a view to devising a way out of the difficulty. Any body or association of important trade interests which wishes to have an opportunity of presenting its views on the subject should communicate with the secretary, Mr. R. C. Smallwood, Ministry of Reconstruction, 2, Queen Anne's Gate Buildings, S.W.

The Reconstruction Advisory Council.—Dr. Addison has now announced the names of the members of the Advisory Council which will assist him in considering the proposals that his Department has to handle. There will be four separate sections :—(1) Finance, Transport, and Common Services ; (2) Production and Commercial Organisation ; (3) Labour and Industrial Organisation ; (4) Social Development (including rural reconstruction). Included in the list are the following :—Sir Henry Birchenough, Sir C. Fielding, Major-General Sir Percy Girouard, Sir R. T. Glazebrook, Mr. W. L. Hichens, Sir Clarendon Hyde, Sir C. Metcalfe, Sir H. B. Rowell, Sir H. Babington Smith, Sir Rowan Thomson, and the various representatives of labour, social, shipping, agricultural, and other interests.

Germany and Raw Materials.—In the course of an article in the *Frankfurter Zeitung* (quoted in the *Times*) the following paragraphs appear :—

"As regards raw materials, our aim will be to make ourselves more independent than we were before of foreign countries. It is assumed that our home production of fibres will provide a substitute for a considerable part of the cotton imports, and in copper we have been able to a large extent to make ourselves independent of foreign countries by our splendid technical achievements.

"Not the least important question to which the Imperial Office for Economics will have to give its attention is the question of the demobilisation of the workmen, which involves the greatest difficulties."

Discharged Soldiers as Tram Drivers.—At the Oldham Local Tribunal, a Corporation tramcar driver (33), married, B 1, was appealed for by the tramway department. The manager was asked why the Corporation supported this man's claim and not those of the other car drivers who had been before the Tribunal during the afternoon. Mr. Priestley replied that there were reasons, but it would not do to go into them in detail. He added that the department was likely to be in some difficulty in the matter of engaging discharged soldiers, as (since the recent accident at Dover, when a number of persons were killed through the act of a driver who was a discharged soldier) the Board of Trade had strongly advised against such men being entrusted with tramcar driving unless they passed a very strict medical examination. The Tribunal granted temporary exemption to July 1st.

Exemption Applications.—At the West Riding Appeals Tribunal, a Harrogate electrical engineer, who had been ordered to get work of national importance and recommended to substitute an engineer at the Furness Hospital at Harrogate, reported that he had not been given the job, as they said he had not enough experience to do all that was required. He was required to do general electrical work, repairs to gas stoves and cookers, to lead pipes and hydraulic lifts, splicing wire ropes, repair and refix fall pipes, repair steam pipes and taps, fix new pipes, mend locks, make keys, grind and set scissors, repair laundry machinery, repair steam engines and make new parts, &c. The National Service Representative agreed that they would never find a substitute to do all that. Exemption was granted to April 21st, conditional on finding work of national importance.

At Wolverhampton, four appeals were made by the Corporation Tramway Department, and the Chairman (Mr. L. B. Moreton) said that he was inclined to believe that two of the men were engaged in work covered by the certified list of occupations. Ald. Craddock said that protection was only given electricians at electrical generating stations. The peculiarities of the municipal tramway system, however, rendered the employment of men similarly skilled indispensable to the carrying on of the undertaking. The decisions were as under :—Battery attendant, six months ; motor man and an electrical fitter, conditional upon their employment ; motor-'bus driver, to join up within a month.

At Nuneaton, exemption was claimed by F. M. Howard (33, B 2), electrician at the Newdegate Colliery. He said that he had a colliery exemption card dated March 16th, and he had had no notification of its withdrawal beyond the calling-up papers. He was still engaged on the same work as when the card was issued. He was advised to return the calling-up papers, stating that he held an exemption card, and the appeal was respited pending the result of this.

High Wycombe Tribunal has granted six months' exemption to E. H. Milner (40, C 1), electrical engineer.

At Mansfield, an appeal was made by Geo. Cooper (35, Grade 2), electrician, who said that his business was now on the exemption list, he having contracts with the military and other important bodies. He was given conditional exemption so long as his occupation is a certified one.

Coventry Tribunal has granted six months' further exemption to R. N. James (31, Grade 3), tramway inspector, formerly in Class B 1.

At Kendal, the Corporation electricity department opposed a military appeal against exemption held by a stoker (41). The appeal was allowed, and temporary exemption until July 15th was substituted.

Hitchin Rural Tribunal has granted four months' exemption to A. Edwards (C 3), electrician, appealed for by Mrs. Sowerby, Offley.

At Barnstaple, the Military appealed against Frank Bickford (Grade 3) and Geo. W. Branch (31, Grade 3), electrical engineers. Each was granted six months' exemption.

At Brierley Hill, Messrs. Holmes & Cartwright appealed for an electrical engineer (28, C 2), and stated that bakers were now arranging for machinery in which to mix potatoes with flour for bread baking, and the man's services were required in installing the necessary plant. He was the only man the firm had left, and his time was almost fully occupied on electrical work at numerous controlled establishments. Three months conceded.

LEGAL.

DETENTION OF CABLES.

In an action, at Dublin, by Messrs. Farrell, timber and iron merchants, Youghal, against a Rathfarnham merchant, for the recovery of about two miles of electrical aerial cables and damages for their detention, the jury found for the plaintiffs, and fixed the value of the wires at £40 and damages for detention at 1s. It appeared that the wires had originally been used in connection with an installation at Rathfarnham. They were purchased by the plaintiffs for use on a lighting scheme for Youghal for £1,200 from Messsrs. Baily & Gibson.

The LORD CHIEF JUSTICE said the action had clearly arisen as the result of a misunderstanding between the parties, both plaintiffs and defendant having acted perfectly *bonâ fide.* The former believed the purchase of the aerial wire by them was complete, whilst the defendant held that he never intended to sell at the sum mentioned.—*Irish Independent.*

HAMMOND BROS. & CHAMPNESS, LTD., *v.* FLOYD.

MR. JUSTICE BAILHACHE, sitting without a jury in the King's Bench Division, on Friday, February 25th, heard an action brought by plaintiffs, electric lift engineers, of Old Kent Road, S.E., to recover damages from Mrs. A. Floyd for alleged breach of contract in respect of the construction of an electric lift at her house in Mayfair. Defendant denied liability, pleading that it was part of the contract that the lift should be placed in the house within two months of the completion of the arrangements, and plaintiffs had failed to do this.

Plaintiffs' case was that in September, 1915, they agreed, at defendant's request, to erect an electrically-worked lift at 30, Norfolk Street, in accordance with specifications submitted, for a sum of £270 and 7s. 6d. per yard for main cables. Defendant, it was said, by a post-card dated December 2nd, 1915, refused to go on with the contract, alleging that plaintiffs had delayed the work. It appeared that an earlier contract was entered into between the parties under which the plaintiffs were to erect the lift with a D.C. supply, but the Metropolitan Electric Supply Co. could not give the continuous current, and the fresh arrangement was made on September 24th, the lift to be worked from an alternating supply. There was some delay in the passing of the plans by the L.C.C. and the necessary building alterations to the premises for the erection of the lift, but the plaintiffs had already prepared to get the material and were ready to complete the construction when the defendant cancelled the contract. They were, however, able to sell the motor and part of the plant they had prepared for the contract, for which they were willing to give the lady credit.

His Lordship, after hearing the evidence of the plaintiffs' witnesses, came to the conclusion that there had been a breach of the contract on the part of the defendant, and gave judgment for plaintiffs for £104, with costs.

BUSINESS NOTES.

Expert Commissioners for the Overseas Markets.—We quote the following extracts from an article on "Investigation of Overseas Markets" appearing in the *Board of Trade Journal*:—

"The Board of Trade have frequently in the past dispatched special Commissioners to examine particular markets. Such missions have been sent to South and Central America, Canada, Australia, South Africa, Persia, China and Russia. In these cases the Commissioner has been charged with the duty of reporting on the prospects of British trade as a whole, but the growing intensity of the competition between manufacturers of various classes of commodities for the trade of the large consuming markets has made it increasingly desirable that a market should be surveyed in respect of any particular industry by men with specialised knowledge. Indeed, the principle is one which has been acted upon by the United States for some time past. Developments accordingly have recently been made on these lines. During last year three technical investigators have been sent to Spain charged with making inquiries with respect to limited ranges of goods. Thus one investigator confined his activities to the electrical trades, another to the marine engineering trade, whilst the third was called upon to cover the iron, steel and engineering trades. These technical investigations of the Spanish market resulted from an appreciation of the fact that an effective investigation of the engineering possibilities of Spain must be undertaken by an engineer, and there seems little doubt that the nature of the reports sent home has fully justified the departure.

"H.M. Trade Commissioners and Commercial Attachés in various countries overseas have recently urged with some frequency the necessity of British traders sending expert investigators in their trades to examine markets abroad. It was urged that, in order to make these investigations effective, it was desirable that the investigator should be selected by the trades concerned, and that steps should be taken to give the investigator an official position, so as to provide that official backing which was used so effectively by the German Intelligence system.

"In the early part of last year the matter was considered by a Sub-Committee of the late Advisory Committee to the Board of Trade on Commercial Intelligence, who were required to report in what industries it would be desirable that efforts should be made to induce manufacturers to combine or federate for the promotion of their joint interests in relation to their export trade, especially for the appointment of travelling investigators in overseas markets, and on the nature of the assistance which the Board of Trade could render in facilitating such combinations. The Sub-Committee took evidence from a number of trades. As a result of the Sub-Committee's investigations, they recommended that the Board of Trade should actively take up the question of facilitating the formation of export associations of manufacturers by placing before representative meetings of manufacturers in such trades the advantages of co-operation for export purposes; by offering to defray part of the cost of the dispatch by such associations of expert investigators to approved overseas markets; and by appointing officers to attend the meetings of the Executive Committees of such export associations in an advisory capacity, when desired. The Sub-Committee considered that the Board should contribute to the expense of the investigations, and that the reports of the investigators should be supplied immediately to members of the associations, and should only be available to the trade generally through the Board of Trade after a lapse of a considerable interval, say, 12 months.

"By the system recommended it is possible to obtain for each trade, at a comparatively small expense to the Government, the advantages which accrue from expert official investigation of overseas markets. The Board of Trade accepted the report, and appointed a Committee, consisting of Sir Henry Birchenough, K.C.M.G., and Mr. Stanley Machin, who are charged with the duty of carrying the recommendations of the Sub-Committee into effect."

Russian Trade.—The January number of *Russia* (6d.) contains a number of interesting articles that should be of interest to all in this country who have been looking to the vast Russian markets with hope during the past three years. The leading article on "1918 and After" deals with the position of the Bolshevist "Government" and analyses the factors making for its coming downfall.

Bankruptcy Proceedings.—*Re* S. S. Coster & Co. (Samuel Stephen Coster, trading as), electrical and mechanical engineers, 14, Gladstone Road, West Ham Park.—The affairs of this debtor came before Mr. Registrar Hope, at the London Bankruptcy Court, on February 20th, in relation to his public examination. He commenced business in August, 1908, and traded till November, 1916, when his stock-in-trade and effects were seized by the Sheriff. A receiving order was made against him last March, under which accounts were lodged showing liabilities £670 and assets "bad book debts, £490." The Senior Official Receiver (Mr. E. Leadham Hough) reported that on December 5th last the debtor was ordered by the Court to lodge cash and goods accounts. The public examination had been adjourned on no fewer than five occasions, but the debtor had not made any attempt to comply with the order of the Court. Under these circumstances, he asked for the public examination to be adjourned *sine die*. In the absence of the debtor, his Honour made an order in those terms.

Catalogues and Lists.—Messrs. Jensen & Nicholson, Ltd., Goswell Works, Stratford, London, E.—New publication giving particulars, preceded by the firm's Roll of Honour, of their electrical varnishes, enamels, &c. These insulating varnishes and compounds will henceforth be graded and classified under registered names, viz., "Lacwatt," "Coilac," "Corlac," "Miclac," and "Mafinel." The goods are of entirely British manufacture.

The Davis Furnace Co., the Diamond Foundry, Luton.—Pamphlet describing their demonstration plant at Luton, and illustrating the various patterns of the Davis patent burners for furnaces fired with gas or oil, as well as Davis crucible furnace installations, natural and induced draught furnaces, &c., for industrial purposes.

Italy.—The Ilva Co., one of the largest industrial concerns in Italy, is seeking to increase its capital from £2,000,000 to £6,000,000. This firm has a working arrangement whereby it directs the operations of six other Italian metallurgical and engineering concerns, thus securing uniformity in output. The object of the firm in seeking this increase of capital is primarily to carry out a programme which will, as far as possible, render Italy independent of foreign supplies. It is intended to develop the scanty fuel resources of the country, and to introduce electric power for the production of steel. A subsidiary company has been formed for supplying the Ilva Co. with the necessary power, and the surplus power will be used for developing electric traction in the South of Italy.

There has been formed the Società Anonima Industria Lampade Elettriche, at Milan, with a capital of 600,000 lire.

The Officine Italiane Costruzioni Elettriche Roseio, Fratelli Partengo e Ca. has been converted into a limited company under the style of Officine Italiane Costruzioni Elettriche, with a capital of 100,000 lire and operating at Milan.

There has also been formed at Milan the Società Anonima Elettrotecnica A. Fantini, for the manufacture and sale of electrical apparatus, with a capital of 300,000 lire.

The Società Elettrificazione Ferrovie del Mezzogiorno, Roma, is a company formed at Rome with the object of planning, carrying out, and working generating plants, transmitting and distributing electrical energy for every use, but more particularly for electric railway traction. Capital, 100,000 lire.

La Motomeccanica Società Anonima has been constituted at Milan for the construction of industrial motors and agricultural machinery. Capital, 100,000 lire.

There has been established at Sampierdarena the Società Anonima "Fatus" Fornitura Articoli Tecnici Utensili, having for scope the representation and sale of technical articles, tools, machinery, and industrial accessories generally. Capital, 75,000 lire.

Book Notices.—*The Great Adventure, or the Passing of National Unrest.* By Cecil Walton, O.B.E. Glasgow: Maclure, Macdonald & Co. 1s. 3d.—The author, who is the general manager of the Beardmore National Projectile Factories at Glasgow, in trying to penetrate the veil which covers the approaching years, attaches a good deal of importance to the unity to be expected from the bearing of common sorrow, and he believes that the problem of combining Capital and Labour can be solved by means of what he terms the "human touch," which will prevent those little causes of discontent which so often in the past have eventuated in a quite unjustified strike. He believes in payment by results—a system in which every worker in a factory receives his percentage on output in proportion to his basic rate. "Cheap labour does not produce cheap goods." "High wages, coupled with high horse-power, is the greatest incentive to cheap production." If the workman be allowed to get the impression that he is being sweated to make profit for another, he will adopt practices which will ensure that that profit is not earned, and the whole nation will suffer. Mr. Walton, in urging the necessity for improved conditions in factory life and showing that the best labour may be expected to migrate to works where such are in vogue is optimistic enough to suggest that "the whole industrial population and the employer are in a state of fusion, ready for solidification." We profoundly hope that he is not wrong, but we must remember that we are under war conditions, with the enemy still at the gate, and with the State as the employer of practically all of us. When the enemy falls back, and State control with the advantages that it has brought to the worker is withdrawn, fusion will be more than ever necessary. It is upon the question how to secure that fusion then that we are all exercising our minds to-day. Mr. Walton finds occupiers of the seat of the scornful scoffing at the idea of the "human touch" in industry, and to these he replies that the sooner we realise that ideals are things to be sought for and not imbecilities to be laughed at, the better for the nation and for the world at large. He proceeds to show how "reconciliation" between employer and employed may be brought about. However well-meaning Parliament may be, Parliament, in his opinion, cannot do this. Those experienced in the problems involved on both sides must themselves move toward each other, and the State could come in to give effect to whatever arrangements they entered into. Want of space prevents our referring to the author's remarks on the skilled man, systems of payment, piecework, hours of labour, unemployment, State control, uncontrolled competition, and so forth, or to a contribution by Mr. J. C. Macfarlane on "National Efficiency," in the course of which reference is made to the "All-Electric Scheme" and various other matters; but those who are making a study of the floods of literature on such subjects that are almost overwhelming us to-day will find the "Great Debenture" a pamphlet worthy of their attention. The object of the author, as we understand it, is to raise discussion on what, next to the war itself, is our greatest problem and duty of the days to come, and to point ways to the making of a programme. He wants everyone down to the lowest grade to be interested in production and to receive payment for all that they produce above a normal output under a wages scheme. This will give increased output, shorten hours of labour, and give every worker an object in life. The capitalist should lend his property to a co-ordinating body elected because of its spécial fitness, under a guaranteed rate of interest.

"Typical Cases of the Deterioration of Muntz Metal (60 : 40 Brass) by Selective Corrosion." Technologic Paper No. 103 of the Bureau of Standards. Washington : Bureau of Standards. Price 10 cents.—This paper reports the study of selective corrosion of Muntz metal, tubings, sheets, and forgings. The condition favourable to such corrosion is the accelerating effect of the closely adhering deposits of chloride resulting from the attack of the metal. Other conditions accelerate the corrosion, such as contact with the more electronegative constituents, increase of temperature, and service stresses. Those interested may obtain a copy by addressing a request to the Bureau.

"A Method for Testing Current Transformers." Bureau of Standards (Scientific Paper No. 309). Washington, U.S.A. : The Bureau.—A general method is outlined in this paper for the determination of the ratio and phase angle of current transformers in terms of the constants of previously calibrated standard transformers of the same nominal ratio. It has been shown that such methods are essentially more sensitive, or, conversely, may be used with much less sensitive instruments, than the laboratory methods now in use. Two of the most convenient of the many possible modifications of the general method are described in detail. Those interested may obtain a copy by addressing a request to the Bureau.

"Glover's Vade Mecum, 1918." Manchester : W. T. Glover and Co., Ltd. Price 12s. 6d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 1. January, 1918. New York : The Institute. Price $1.

The *Revue Générale de l'Electricité* announces the establishment of a new journal, the *Journal de la Houille Blanche*, dealing with all matters connected with hydro-electric power, including its industrial applications.

Dissolutions and Liquidations.—Brown & Co., joiners and general wood workers, Waterloo Sawmills, Glasgow.—Mr. G. Miller retired from the firm last September. Mr. W. Jeffrey is continuing the business under the same name, and will attend to debts, &c.

Rotherham Electrical Engineering Co., Ltd., Rotherham.—First meetings of creditors and contributories March 1st at Sheffield.

Patent Application.—Application has been made by Jens Orten Boving for the restoration of his patent No. 11,411 of 1910 for "An improved method of and apparatus for compressing air or other gases."

Fire.—An outbreak of fire recently occurred at the workshops of Messrs. Park Bros., Ltd., electrical engineers, Ealing.

Grinding Allowance Chart.—Messrs. Alfred Herbert, Ltd., of Coventry, have sent us a copy of a chart which they have just issued, showing the allowances that should be made on turned or bored work which is to be finished to size by grinding, in order to avoid waste of time and labour. The chart covers work up to 12 in. in diameter and of various lengths. A copy of it will be sent by the firm post free to anyone interested.

LIGHTING AND POWER NOTES.

Aberystwyth.—E.L. Scheme.—Mr. A. J. Hodgkinson-Carrington has offered to the T.C. a perpetual lease of the water rights and land for £250 a year for the proposed Rheidol hydro-electric lighting and power scheme, and to make surveys and supply plans and sections of the ground for 100 guineas. The matter has been referred to the Public Works Committee.

Barnes.—The Special Committee appointed to consider the report of the L.C.C. Committee as to the establishment of a central authority, to be known as the Greater London Electricity Board, has recommended the District Council not to agree to the proposition, and to withdraw from the Conference of Local Authorities Owning Electricity Undertakings. The recommendation has been agreed to by the Council.

Blackpool.—During January 651,242 units were generated at the Corporation electricity works, an increase of 43,880 on the corresponding month of last year. The total for the past 10 months was 4,872,184 units, an increase of 449,836 on the previous similar period.

Brighton.—Loan Application.—The borough electrical engineer (Mr. J. Christie) has been in negotiation with the proprietors of a new diamond-cutting factory for a supply of power estimated at 800 H.P. ; the cost is estimated at £10,000 for mains, plant, &c. Application is to be made to the L.G.B. for sanction to a loan.

An experimental modified form of street lighting arranged by the borough electrical engineer, with the consent of the Chief Constable, is to be extended to the principal central traffic routes of the town.

The Council has approved of the grant of a 12½ per cent. bonus to the employés of the electricity undertaking, provided that the resolution shall not apply to employés in receipt of more than £250 per annum or to women or to male employés under 21.

Bury.—There is a profit of £2,668 on the electricity undertaking for the past year.

Coventry.—Loan Application.—The City Council has decided to apply to the L.G.B. for sanction to a loan of £25,000 for extension of mains.

Falkirk.—Price Increase.—The following new charges have been imposed by the T.C. :—Large power (over 20 H.P. installed), £4 per H.P. of demand and 1¾d. per unit ; small power (up to 20 H.P. installed) maximum demand, 4½d. per unit for first hour of maximum demand and 3d. per unit for remainder ; small power (flat rate), 4¼d. per unit ; lighting, 6d. per unit ; outside lighting, 5½d. per unit ; theatre lighting, 5½d. per unit ; theatre power, 4¼d. per unit.

Farnworth.—The directors of the Suez Doubling Mill, Worsley Road, have decided to install an up-to-date electrical installation, and Mr. Hutchinson, electrical engineer to the Farnworth U.D.C., has been engaged as adviser.

Glasgow.—Linking-up.—The Electricity Committee has received a letter from the Ministry of Munitions regarding the application of the Electricity Department and the Clyde Valley Electrical Power Co. for authority to put down additional generating plant at their respective works, and indicating the desirability of (1) interlinking the two electric supply systems ; and (2) setting up a Joint Committee or board, consisting of an equal representation of the Corporation and the Clyde Valley Electrical Power Co., for the purpose of considering with the Ministry of Munitions what is the best policy to adopt for an extension of plant for the industrial area served by both undertakings. The Committee, after considering the letter, agreed to recommend that it be remitted to a special Sub-Committee for the purpose of considering the proposals, and, if so advised, conferring with the Ministry of Munitions thereanent.

Permission has been granted by the B. of T. to the department temporarily to discontinue the supply of energy to certain consumers.

Loan Application.—The town clerk is to make application to the Secretary for Scotland for authority to borrow £750,000, which, with the present unexhausted borrowing powers, will meet the requirements of the electricity department for the next 12 months. This recommendation was come to after consideration of a report by the engineer, from which it appeared that the total borrowing powers were £3,321,478, and that £3,156,054 had been borrowed to date. It was explained that the position was (1) amount required for Dalmarnock station and connections : (*a*) contracts in operation, £593,000 ; (*b*) contracts for turbo-alternators, switchgear, batteries, and brick and masonry work of boiler, turbine, and switch houses, £248,000—£841,000 ; (2) amount required for general expenditure during year, £150,000 ; making a total of £991,000, less balance of borrowing powers noted above, £165,424—£825,576 ; and less depreciation for the year 1917-18, £60,000—£765,576.

Huddersfield.—Year's Working.—The income of the electricity department for 1917 amounted to £87,588, an increase of £8,079 over that of the previous year. The expenditure was £63,959, an increase of £9,093, leaving a gross surplus of £23,637 as compared with £24,651. After paying £11,326 for interest and £9,213 for redemption of capital, £2,250 is being allocated towards the relief of the rates, and the balance of £847 is being placed to the depreciation fund.

Linking-up Schemes.—A conference of the heads of the Lancashire and Cheshire electricity supply systems, and the Mayors of various towns in the two counties was held in the Manchester Town Hall on Friday last. Sir Guy Calthrop, the Controller of Mines, spoke on the necessity for a further conservation of coal supplies in electricity and other municipal undertakings, and a discussion also took place on the scheme for the interconnection of the electricity supply systems in Lancashire and Cheshire. To carry out the scheme, some 62½ miles of mains will have to be laid to interconnect the various undertakings, and the estimated expenditure is £281,397.

The Rotherham Council has approved the proposal of the Joint Sub-Committee of Sheffield and Rotherham to obtain a report from Sir John Snell and Mr. Charles Merz as to the best method of providing a supply of electrical energy to Sheffield and Rotherham and the surrounding district, including the supply of electricity to the South Yorkshire coalowners, and that the representatives of the Rotherham Corporation be given authority to complete the arrangements for carrying this out.

London.—Stepney.—Price Increase.—The Electricity Committee recommends that the practice of charging lighting-consumers in the summer months at the higher rate for two-thirds of the average March quarter's demand be discontinued, and that the summer months' accounts, in accordance with previous practice, be based upon the full average of such demand; and that the charge of ½d per unit (subject to the advance of 50 per cent. now in operation) to consumers guaranteeing from £60 to £200 per half-year in respect of energy supplied under Scales D, E, and F be increased to ¾d. per unit.

Fulham.—Price Increase.—The Electricity Committee recommends increasing the charges for private lighting to 6d. a unit and for power and heating to 1¾d. per unit.

Hackney.—Loan Sanction.—The Finance Committee has been in communication with the L.C.C. with regard to the sanction to the borrowing of £40,000 and £28,000 for machinery and boilers for the electricity undertaking. The L.C.C. considers that the repayment of the loans which the B.C. raised at the commencement of the electricity undertaking on a 42 years' basis should be expedited, as the average unexpired period is 25½ years, and suggests that the period should be reduced by one half.

The Finance Committee reports that the change will increase the loan charges by approximately £2,000 per annum, and recommends the B.C. to agree to the conditions.

Power Bills.—The Newport and Cannock U.D.C.'s and the Shifnal R.D.C. have decided to lodge petitions against the Worcestershire, Shropshire, and Staffordshire Electric Power Bill.

The Saddleworth Council has decided to oppose the Yorkshire Electric Power Co.'s Bill.

Rochdale.—A remarkable wages application was made to the Electricity Committee last week. The grant of 12½ per cent. bonus to electricity workers was made retrospective from the beginning of October; several men who had left the service of the department in the interval applied for the 12½ per cent. from that date until the time when they left to enter other employment, but the Committee declined to grant the request.

Spenborough. — Price Increase. — The D.C., last week, decided to increase the charges for electricity as from April 1st by 50 per cent. to special-rate power consumers; by a halfpenny per unit, and the addition of 10 per cent. to the net amount of the account of flat-rate power and ordinary lighting consumers; and by a halfpenny per unit up to the minimum of demand and a farthing per unit above the minimum, plus 10 per cent. on the net amount of accounts, for "H.P." consumers. The estimated loss for the nine months ended December 31st last was stated to be £1,262, and the estimated product of the increased charges for one year is £2,306.

Swinton and Pendlebury.—The U.D.C. has referred to the clerk and electrical engineer an application from the Lancashire Electric Power Co. for permission to supply electricity direct to the works of Messrs. Gerrard & Sons.

Tynemouth.—The annual report of Mr. C. Turnbull, the borough electrical engineer, for the year ended March 31st last, shows that 4,609,409 units were sold, as compared with 4,528,958 in the previous year, the three-phase supply accounting for 2,690,370 units. The total revenue amounted to £22,435, and after meeting all charges, there remains a deficit of £126, as compared with a deficit of £513 in the previous year. In his report, Mr. Turnbull states that in spite of war conditions the charges for electricity have not been increased in any way, and that the small deficits since the war began have been met from profits in hand, leaving a balance of £1,185 to meet future contingencies.

TRAMWAY AND RAILWAY NOTES.

B. of T. Tramway Conferences.—A conference of representatives of municipally and privately-owned Scottish tramway undertakings was held in Glasgow recently for the purpose of discussing the adjustment of the working of the concerns to meet national needs. Mr. Devonshire, chairman of the B. of T. Tramway Committee, who presided, indicated that among questions which he expected would be dealt with were the increase of fares, through the abolition of the halfpenny fare, rates for conveyance of parcels and goods, the labour problem, the better utilisation of tramcars in the distribution of food, and the transference of material and equipment. To form an Advisory Committee he suggested the appointment of one member, perhaps the manager, of each tramway concern. In the course of a general discussion it appeared that the replacement of male drivers by women had been satisfactory, Paisley being the only case in which women drivers were said to be non-successful.

Mr. Fell, L.C.C. Tramways, stated that whenever a question of policy was raised, such as the suggested closing of a route or portion of a route, and the subsequent lifting of rails for transference to other sections, a local inquiry would first be held, and the opinion of the local Tramway Committee or concern invited. It was agreed to appoint an Advisory Committee consisting of one representative from each concern, with Major Coutts (Paisley) as honorary secretary. In a concluding statement, Mr. Dalrymple (Glasgow) said matters would have to be very serious before they took the extreme step of closing an undertaking. At the same time, some of them might have to close particular routes, or parts of routes, and possibly might have to lift the rails on those routes. In the central part of Glasgow the track was getting into a very bad condition.

An important conference of Lancashire and Cheshire tramway authorities was held at Liverpool Town Hall, on Thursday last week, relative to the establishment of an Advisory Committee for the area. Representatives of 32 municipal and company owners of tramways were present, with representatives of Corporations which are lessors of tramway tracks. The Lancashire and Cheshire area is one of the smallest of the eight into which Great Britain has been divided in connection with the scheme of tramway control, but it is also one of the most important.

Mr. James Devonshire, chairman of the Board of Trade Committee, presided, and pointed out that the Board of Trade did not wish to control tramway undertakings, but rather to relieve them of as many of their difficulties as possible. The area, like each other area, would have its own Advisory Committee, elected by itself, which would have charge of such questions as labour, rails, permanent way, rolling stock, car equipment, and priority for materials. He hoped all tramway authorities would conduct all negotiations for tribunal exemptions through the Board of Trade Committee, which had been given a seat on the Ministry of National Service. Referring to the labour question, Mr. Devonshire said that in Glasgow 92 per cent. of the tramway employés were women. Concerning the prevention of rush traffic at certain hours, he advocated an arrangement by which big works should open at varying times, as adopted in London, which had been a great relief to the tramways. It was also worth while asking ladies to finish their afternoon shopping before 5 p.m. Some tramway authorities, by a course which in pre-war times would have been considered very prudent, were now hoarders of materials, and they would have to be talked to. There was a hope that some rails would be allowed to be rolled, and these would have to be allotted impartially. It would not be possible to purchase new cars, and the Board of Trade might, perhaps, have to determine which undertakings should be partly or wholly discontinued in order that material might be transferred to undertakings of greater importance. The Ministry of Munitions had already made a complete survey of the tramways of the country, and if it became necessary to declare any non-essential, he hoped tramway owners would render every assistance.

The Conference decided upon the establishment of a single Lancashire area, each municipality or company, whether large or small, to have a single representative, and the lessors also to have one representative each on the Advisory Committee. Replying to Mr. Day, of Manchester, the Chairman stated that the Advisory Committee would suggest the amount of compensation for any undertaking which might have to suffer for the benefit of another. Mr. J. Barnard, manager of the Bolton Corporation Tramways, took the office of hon. secretary to the Advisory Committee.

Mr. James Devonshire, on Friday last, at Birmingham, met the representatives of the electric tramway undertakings in No. 4 Area, which includes Birmingham, Leicester, Nottingham, Northampton, the Potteries, and the other tramway undertakings in the Midlands, in conference on the subject of the working of tramways in war time. It was decided to form an Advisory Committee consisting of an officer of each undertaking in the area. Mr. Alfred Baker, manager of the Birmingham Electric Tramways, was appointed chairman, with Mr. R. L. Horsfield as hon. sec. The duties of the Advisory Committee are consultative, and not executive.

On February 19th, a Conference was held at Newcastle-on-Tyne, at which Mr. James Devonshire presided, for the purpose of appointing a local Advisory Committee. After explaining the objects of the B. of T. Tramways Committee, the chairman stated that steps had already been taken to enable tramway undertakings to increase fares beyond the existing statutory maxima, and that it was desirable, to facilitate this movement, that resolutions passed locally advocating such increases should be forwarded to the Committee. The rates chargeable under the Act of 1870 for the carriage of goods or parcels were quite inadequate, and there was reason to believe that they would soon be raised. An Advisory Committee was appointed, with Mr. George A. Carr, of the Newcastle Tramway Offices, as hon. secretary.

In reply to questions, Mr. A. L. C. Fell stated that one of the duties of the Committee was to value materials and plant released by the closing of tramways, and to assess the compensation payable therefor and for the loss of revenue. By making arrangements with the Woolwich Arsenal authorities the L.C.C. tramway system had been enabled to carry three times as many passengers as previously, and the peaks had been adjusted so that they had a constant load for several hours.

Blackpool.—With over six weeks to run, the receipts on the Corporation tramways are already £10,000 ahead of last year's record. The receipts from April 1st last to February 14th were £104,069, and nearly 3¼ million more passengers were carried. The receipts per car-mile at 1s. 10½d. show an increase of 2d. The increased receipts during the past month amounted to nearly £2,000.

Motor Vehicles.—The Cleansing Committee has already three electric motor vehicles in service, and last week decided to add another to the fleet, at a cost of from £800 to £900.

Bury.—Year's Working.—There is a profit of £4,299 on the working of the tramways for the past year, including £1,457 transferred from the reserve fund.

Glasgow.—Too high a speed on a sharp curve—darkness and the misapplication of the mechanical brake being also factors—was the cause assigned by Colonel Pringle, Board of Trade inspector, for the overturning of a Glasgow tramcar on December 5th last, whereby three persons were killed and 56 injured. Colonel Pringle comments on the fact that the car was driven by a lad of 16, and recommends raising the age limit to 18. The employment of women as tramcar drivers has not been an unqualified success, due to their incapability of standing the strain of responsibility and physical effort involved. Out of 800 women trained by the Corporation, only 266 have been retained. Colonel Pringle adds that perhaps something could be done to reduce the strain and physical effort in tramcar driving by shortening the hours of duty, giving longer intervals of rest, minimising the effects of exposure to weather, and by better illumination in the streets, and thereby to induce them to undertake the responsibilities in larger numbers.

Leeds.—The system of parcel distribution by tramway, which is shortly to be commenced in Leeds, is, in one essential respect, entirely unlike that which has been in operation in Bradford for many years. The cars will be special parcel cars, leaving the central parcel depôts for the various districts—and *vice versâ*—at set times each day, and will not carry passengers, whereas in Bradford the parcels are carried largely on the ordinary tramcars, accompanied, sometimes, by a uniformed parcel boy and a hand-truck, and motor vans are also in use. The parcel cars at Leeds will have a distinguishing sign by which passengers will recognise them at sight. In the absence of adequate petrol and horse transport, the traders of the city are offering to lend hearty support to the scheme.

Liverpool.—The Tramways Committee is to present a requisition to the Board of Trade, asking for :—(1) 200 men to bring into use 100 cars urgently required on the streets, but sent into the sheds for want of labour ; (2) 35 additional motor-omnibuses ; and (3) about £50,000 value of materials required in connection with the undertaking.

Llandudno.—The Llandudno and Colwyn Bay Electric Railway Co. has formally accepted the notice of the U.D.C. to terminate next January the contract under which it supplies energy for the working of the light railway.

London Electric Railways.—The report of the London Electric Railway Co. for the past year shows that war conditions have greatly increased the traffic on all the underground railways, leading to serious difficulties at some of the stations at the rush hours, which cannot at present be met by improved facilities. The expenses of operation have also increased. The gross receipts of the London Electric, Metropolitan District, Central London, and City and South London Railway Companies, and the London General Omnibus Co., Ltd., amounted to £6,661,863, an increase of £623,334 over the corresponding period, and the expenses increased by £609,964, of which nearly half was due to increased war bonus to the staff, raised from 10s. to 21s, per week, and converted into war wages. The total increase in the wages bill by the end of 1917 was at the rate of £500,000 a year. Increased fares came into force in August. The combined earnings of the five companies after paying operating expenses, debenture interest, and preference dividends, and providing for reserves, were £520,337, an increase of £13,370. The London Electric Railway Co. receives 30 per cent. of this amount, or £156,101, making, with £24,474 brought forward, a total of £180,575 ; after allocating £10,000 extra to reserve and paying 1½ per cent. dividend on the ordinary shares for the year, £30,656 remained to be carried forward.

The through service to Watford on the L. & N.W. Railway and the Bakerloo Railway was inaugurated on April 16th. Previously passengers changed at Willesden, and the revenue was £16,953 ; as the result of the through service (for 8½ months) the year's receipts increased to £58,362. Out of 25,000 employés over 14,500 are or have been on war service, of whom 902 have been killed and 1,075 wounded, 204 being prisoners of war or missing.

The electrification of the L. & N.W. line from Watford to Euston has been completed as far as Queen's Park, but the work on the remaining section has been stopped by the Ministry of Munitions.

The electrification of some of the suburban lines of the London and South-Western Railway has resulted in an increase of nearly 10 million passengers as compared with 1915. The service has proved so popular that houses are at a premium in the districts served. The extension of the electrification has had to be deferred, and the electric rolling stock cannot be increased at present to meet the needs of the traffic.

London Tube Railway Breakdowns.—Three of the London tube railways were disorganised at a busy hour on Monday morning, and thousands of passengers proceeding to the City were inconvenienced. The railways were the Bakerloo, the Piccadilly, and the Hampstead and Highgate tubes, and stations as far apart as Earl's Court and Watford were affected.

The trouble arose from the shoe of a train on the Bakerloo line becoming loose at Paddington. The mishap automatically caused all signals on the Hampstead, Piccadilly, and Bakerloo lines to go to danger. A Bakerloo train stopped outside Warwick Avenue Station, but the driver of the following train, thinking the signals had failed, went on very slowly, and his train came into collision with the stationary train. The passengers on the stationary train alighted at the platform, but those on the colliding train had to walk back through the tunnel. The passengers were unhurt, but three employés, including a motorman, were seriously injured.

The short-circuit at Paddington presumably caused heavy surges of current throughout the railway system. Fires burst out in the motors of two tube trains. In one case the train had just entered Paddington Station, and the passengers were able to alight without difficulty. The second case occurred in a tunnel between Golders Green and Hampstead stations, and smoke poured out from the first coach. The lights in the train went out, and passengers, becoming alarmed, rushed to the rear of the train. The rear doors were opened, and the passengers climbed on to the line and walked to Golders Green, which is aboveground. Meanwhile smoke had been seen issuing from the tunnel mouth, and assistance was sent. The driver, F. Cavalier, remained at his post, and, with the assistance of some passengers, extinguished the flames with sand.

Morecambe.—Owing to the shortage of motor spirit, the Morecambe Tramways Co. have had to adopt gas for driving their petrol-electric cars between Morecambe and Heysham.

North Staffordshire Railway.—Lord Anslow, presiding at the annual meeting of the North Staffordshire Railway Co., stated that an electric shunting locomotive in connection with quarry works at Oakamoor had been provided, and was working most satisfactorily. Electric track circuiting was being proceeded with, and being put more and more into use. This was a great factor in the safety of their railway working. The company was also going in for the electric lighting of signals, which would effect a great saving in petroleum and in labour.

Rawtenstall.—The Corporation tramways in January carried 23,000 more passengers than a year ago, with 1,844 fewer car-miles run, the receipts per car-mile rising by over 3d. In order to prevent overcrowding, instructions have been issued that not more than 75 passengers must be allowed on one car.

Rochdale.—Electric Vehicles.—The three electrically-driven motor vehicles which the Cleansing Committee recommends shall be purchased will cost about £5,000. Two of them will be 5-ton vehicles and one 3½ tons. The vehicles will be in use during the night time by the cleansing department, and in the day time by the Gas and Electricity Committee for the cartage of coal and ashes, the latter Committee being charged 1s. 10d. and 1s. 8d. per ton respectively.

Southport.—Tramway Purchase.—The T.C., on Feb. 19th, decided to purchase the estate of the Southport Tramways Co. for £35,000, less the sum of £1,200 to be repaid on revenue account. The transfer is to be effected as from January 1st, and the actual working by the Corporation commences to-day.

TELEGRAPH AND TELEPHONE NOTES.

Guernsey. — The annual report for 1917 of the Guernsey States Telephone Department, of which Mr. R. McLean is the manager and engineer, shows that the income from all sources was £7,841, and the expenditure £7,288, leaving a net profit of £553. The number of subscribers' lines, &c., was 2 281, an increase of 46 ; the mileage of wire was 1,544 overhead, and 1,060 underground. The number of calls dealt with was over 1½ millions.

Halifax.—Two boys were fined 10s. each, last week, at the local Police Court, for throwing stones at telephone insulators. It was stated that recently 87 insulators on telephone poles in that locality had been broken by stone throwers.

Night Telegrams.—The Postmaster-General announces that, on account of the difficulty of obtaining sufficient messengers and the reduction of all travelling facilities, it is impracticable to continue the delivery of telegrams for the whole of the London postal area throughout the night. Telegrams for addresses within a radius of four miles of the Central Telegraph Office or West Strand Telegraph Office will be delivered up to 10 p.m., and after that hour if the text seems to indicate special urgency. The delivery of telegrams for more distant parts of the London postal area will, however, cease at 8 p.m. Telegrams bearing telephonic addresses will be delivered at all times from the Central Telegraph Office by telephone, as well as telegrams for telephone subscribers who have registered addresses and have given standing instructions for telephonic delivery.—*Daily Telegraph*.

Wireless Equipment on Submarines.—According to the *New York Times*, wireless communication is so vital to submarine boats that the problem has been attacked with unusual energy. Improvement in wireless equipment and methods has been amazing. Even at the beginning of the war the methods were comparatively crude, and the most remarkable advance has come only within the past few months.

At first a special mast was set up amidships when the U-boat came to the surface, and the aerial was strung from the top of it to the ends of the deck. The aerial was thus raised 8 ft. or 10 ft. at most. Such an aerial would receive messages from perhaps 200 miles. The sending radius was naturally limited. The next step was to raise two masts, one at either end of the boat, and string the aerial between them. Telescopic masts then appeared, marking a great advance. When the submarine came to the surface, these masts were quickly pulled out to their extreme length of perhaps 15 ft.; the range for both sending and receiving messages was thus much increased.

Several German boats have been captured carrying an ingenious device for winding up the antenna automatically in order to save a few priceless seconds. The wire is coiled up instantly by a spring.

The newest German device for extending the range of wireless signalling is the use of balloons. The success of the U-boats is believed to be largely due to this. Antennæ are raised to a height of at least 2,000 ft. above the sea by means of two balloons connected by a stiff rod. When an enemy is sighted, they are pulled down quickly by means of a windlass operated by electricity. The balloons are painted partly white and partly blue, so that they are scarcely distinguishable from the sky. It is practically impossible, therefore, to bring them down with anti-aircraft guns. With the antennæ raised to the height of half a mile, it is possible to receive wireless communications from almost any part of the world. Some U-boats nowadays displace 1,500 tons and have a cruising radius of 6,000 miles.

The U-boats are also equipped with sound-transmitting devices, which may be classed as wireless signalling apparatus.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump.

June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Belfast.—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" February 22nd.

Cavan.—March 4th. B. of G. Storage battery, wiring, electrically-driven pumps, pipes, &c. See "Official Notices" February 15th.

Dublin.—March 8th. Electricity Supply Committee. 1,760 yards of 3½-in. fibrous troughing. See "Official Notices" to-day.

Fleetwood.—March 11th. U.D.C. Mechanical stoker for the electricity department. See "Official Notices" to-day.

Keighley.—Keighley and Bingley Joint Hospital Board. Electricians' work at Keighley War Hospital for a year.

London.—H.M. Office of Works. March 4th. Six months' supply of electrical accessories. Controller of Supplies, King Charles Street, S.W.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

Portsmouth.—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" February 22nd.

CLOSED.

New Zealand.—The Public Service Tender Board, Wellington, has accepted the following tenders:

30,000 porcelain insulator caps, £562.—J. A. Redpath & Sons.
60 miles twin-twisted rubber-insulated wire, 1/20, £1,305. Richardson, McCabe & Co.

New Zealand Shipping and Commerce.

Government Contracts.—List of new contracts placed in January, 1918:

X-Ray apparatus.—Watson & Sons (Electro-Medical), Ltd.
Copper wire cord.—Shropshire Iron Co., Ltd.
Generating sets.—H. T. Boothroyd, Ltd.; Lyon & Wrench, Ltd.
Motors.—H. T. Boothroyd, Ltd.; Electrical Apparatus Co., Ltd.; Electrical Construction Co., Ltd.; Mather & Platt, Ltd.
Iron & steel wire.—J. C. Hill & Co., Ltd.; Rylands Bros, Ltd.; Shropshire Iron Co., Ltd.
Works services.—Electric lighting: Ellis & Ward, Ltd.; Jackson & Boyce.

H.M. Office of Works.

Electric bell fittings.—Siemens Bros & Co., Ltd.

Post Office.

Protective apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telegraph apparatus.—Isenthal & Co., Ltd.
Telephone apparatus.—Peel-Conner Telephone Works, Ltd.
Testing apparatus.—Evershed & Vignoles, Ltd.; Reid Bros., Engineers, Limited.
Telegraph cable.—British Insulated & Helsby Cables, Ltd.; General Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; C. Macintosh & Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros & Co., Ltd.; Western Electric Co., Ltd.
Telephone cable.—Western Electric Co., Ltd.
Cords for telephones.—British Insulated & Helsby Cables, Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Cable distribution plugs.—British Insulated & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.
Bronze wire.—T. Bolton and Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated with the London Electric Wire Co., & Smiths, Ltd).
Galvanised iron wire.—Dorman, Long & Co., Ltd.; Ryland Bros., Ltd.; Shropshire Iron Co., Ltd.; Whitecross Co., Ltd.

Public Works, Ireland.

Electrical works and supplies, Belfast District.—A. Stevenson.

FORTHCOMING EVENTS.

London Association of Foremen Engineers.—Saturday, March 2nd. At 7 p.m. At the Cannon Street Hotel, E.C. Paper on "Painting and Wood-Finishing from the Engineer's Standpoint," by Mr. A. S. Jennings.

Salford Technical and Engineering Association.—Saturday, March 2nd. At 7 p.m. At the Royal Technical Institute. Paper on "Road Transport," by Mr. H. Hodgson and Mr. N. E. Box.

Chief Technical Assistants' Association.—Saturday, March 2nd. At 3 p.m. At the Tavistock Hotel. Annual general meeting.

Royal Institution of Great Britain.—Saturday, March 2nd. At Albemarle Street, Piccadilly, W. Lecture on "Problems of Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S.

Greenock Electrical Society.—Thursday, March 7th. At 7.45 p.m. At 22, West Stewart Street. Juniors' night.

Institution of Civil Engineers.—Tuesday, March 5th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "Modern Developments in Gasworks Construction," by Mr. A. Meade.

Royal Society of Arts.—Wednesday, March 6th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Foundation of Industrial Peace," by Mr. A. H. Paterson.

Monday, March 4th. At 4.30 p.m. (Cantor Lecture.) "The Effects of the War on the Economic Condition of the United Kingdom," by Mr. E. Crammond. (Lecture III.)

Institution of Electrical Engineers.—Thursday, March 7th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(Dublin Local Section).—Friday, March 8th. At the Royal College of Science. At 8 p.m. Ordinary meeting.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, March 9th. At the Royal Technical College, Glasgow. At 4.30 p.m. Paper on "Conservation of Exhaust Steam and its Utilisation," by Mr. J. Watson.

NOTES.

Electrical Goods for Use in Ontario.—The Hydro-Electric Power Commission of Ontario has sent out a notice regarding the sale of electrical products in the Province of Ontario, dated January 1st, and stating that the Commission orders that on and after three months from the date of the notice no electrical machinery, apparatus, appliances, devices, material, or equipment may be used or disposed of in the Province of Ontario unless the design and construction of the same has been submitted to the Hydro-Electric Power Commission, and approval of such has formally been obtained.—*Electrical World.*

Large Increase in Use of Electric Appliances.—During the year just closed the sale of electric domestic appliances in the U.S.A. showed a tremendous advance, chiefly due to the growing scarcity of domestic labour; another factor in the increased purchase of appliances has been the better earnings received by the wage-earners generally. A total of 13,545 electrical appliances were placed on the Minneapolis General Electric Co.'s lines during the period from January 1st to November 1st, 1917. Electric flat-irons were the most popular of all devices sold, the total numbering 4,601. Electric vacuum cleaners were next, the total being 3,091. The other appliances in the order of number of sales ranged as follows:—Toasters, 987; washing machines, 612; heating pads, 401; grills, 384; curling irons, 343; percolators, 324; ranges, 223; air heaters, 214; vibrators, 154; water heaters, 138; luminous radiators, 96; chafing dishes, 85; hot plates, 84; miscellaneous, 1,807.—*Electrical World.*

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 9th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. W. J. A. Watkins.

Next for Duty. Second Lieut. E. A. Ullmann.

Monday, March 4th.—No. 3 Company, 6.30–8.30. Recruits' Drill, 6.30–8.30. Signalling Section, 6.30—8.30.

Tuesday, March 5th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 6th.—No. 1 Company, Entrenchment, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 7th.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 8th.—Musketry, 5.30—8.

Saturday, March 9th.—Knotting, lashing, and splicing for the whole corps, 2.45–4.45. Musketry, 2.45–4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Hydro-electric Power and University Instruction.—With the development of hydro-electric power in the Alpine and other regions of France, certain industries (*e.g.*, electro-chemistry, electro-metallurgy, general mechanical engineering, paper making, &c.) are also being developed *pari passu*. Grenoble, which is in the centre of important hydro-electric undertakings, thus assumes great importance. The Polytechnic Institute attached to the University evidently means to keep pace with the requirements which will grow for technically-trained men for the electrical and allied industries. In an article in *La Nature* for February 9th the director of the Polytechnic gives an outline of the courses held at the institute. The establishment comprises (1) a higher school of electro-technics for training electrical engineers, electro-chemists, electro-metallurgists, &c.; (2) an elementary electro-technical school; (3) an electrical standardising and testing laboratory; (4) a school for the paper-making industry; (5) a paper-testing laboratory; (6) an electro-chemical and electro-metallurgical test station with a 1,000-H.P. experimental plant. A chair of electro-chemistry and electro-metallurgy has also been established at the University.

The article referred to gives further particulars as to numbers of students, the granting of diplomas, &c., and it is stated that the courses in question will be open to foreign students who have had a higher education in a college or similar establishment.

B.E.A.M.A.—We are informed that the following firms have been elected members of the British Electrical and Allied Manufacturers' Association:—

Abbott, Anderson & Abbott, Ltd. ..	London.
Atlas Carbon and Battery Co., Ltd.	London.
British Battery Co., Ltd.	Watford.
British Central Electrical Co., Ltd. ..	London.
British Ever-Ready Co., Ltd. . ..	London.
Concordia Electric Wire Co., Ltd.	London.
Crighton & Co. ..	Stockport.
Davenport Engineering Co., Ltd. . .	Bradford.
Ecco Battery Co., Ltd. ..	London.
Efandem Co., Ltd. ..	Wolverhampton.
Film Cooling Towers, Ltd. ..	London.
Fleming, Birkby & Goodall, Ltd.	Liversedge.
Foster Instrument Co. .	Letchworth.
Lancashire Water Cooler Co.	Salford.
Mackley, E. N., & Co.	Gateshead.
Manley, J. W.	New Barnet.
Quead, Ltd.	London.
Sunlight Manufacturing Co., Ltd. . ..	London.
Trevelyan & Co.	Birmingham.
Vulco Dry Battery Co. ..	London.
Ward & Goldstone	Salford.

Fatality.—An inquest was held recently at Haltwhistle into the death of John Kennedy, electric pump man at South Tyne Colliery, who was found dead in the pump house. Medical evidence described the circumstances under which Kennedy was found, and concluded that Kennedy had received an electric shock. The broken nose must have been due to the fall. The trousers were scarred where the knee had been burnt. The man's lamp had been found lying beside him still burning, which could also account for the knee being burned. The colliery manager, Mr. W. E. Donald, said that, so far as they knew, the electrical installation was quite in order. As the pump stopped, the deputy went to see what was the matter, and found the body.

National Insurance (Part II) (Munition Workers) Act, 1916.—The following is a further decision of the Umpire:—Contributions are payable in respect of:—

2.414 X. All workmen engaged in removing wire, canvas, or other foreign substances from rubber waste preparatory to the recovery or reclaiming of the rubber.

This decision amplifies decision A 1.639 X (*Board of Trade Journal* of August 24th, 1916).

"Safety First."—As a result of the "safety first" campaign, the number of accidents per 100,000 miles run by the London General 'Bus Co.'s vehicles last year was reduced to 22½ per cent. below that of 1916, and the number of fatal accidents was reduced by 27·8 per cent.—*Daily Chronicle.*

Electric Motor Vehicles.—In connection with the existing prohibition of the use of petrol motor vehicles except for business purposes, it was announced in Parliament, last week, that there is at present no official intention to issue regulations as to the consumption of electricity by vehicles used for purposes of pleasure on similar lines to those in force as regards the use of petrol, petrol substitutes, or gas.

Institution and Lecture Notes.—Allen West Engineering Society. The usual fortnightly meeting of the above Society was held on February [illegible] at Brighton, when a paper was read by Mr. F. G. Smith, joint managing director of Messrs. Wellman Seaver & Head, Ltd., entitled "Steel Works Charging Machinery." The speaker dealt very fully with the design and construction of various types of charging machines, and showed in a very lucid and forcible manner the service to which these machines were subjected; as he was addressing employés of an electric control firm, he pointed out the operations each individual motor and controller was called on to do, and placed before the Society various electrical problems which had arisen in connection with steel works machinery. An interesting discussion followed the paper, and in seconding a vote of thanks to the author, Mr. Allen West pointed out the enormous advantage to the members of the Society in having such an authority as Mr. Smith come to Brighton to tell them of steel works machinery. The co-operation of mechanical and electrical engineers in dealing with such problems would ultimately lead to improved designs and closer standardisation.

The Association of Engineering and Shipbuilding Draughtsmen (Merseyside Branch).—At the Liverpool University on Thursday, 21st inst., under the auspices of the Association, a paper was read by Mr. D. S. Macbeth on "Technical Education in its Relation to Draughtsmen." The author dealt with the subject from three points of view, viz.:—The draughtsman's work, his training for that work, and his prospects. He opened with a brief survey of the varied problems with which the draughtsman has to contend, showing the need of a scientifically trained mind, and insisted that admission to the drawing office should in all cases be by examination, as was now done by several firms, thereby ensuring that none but those showing a natural inclination for the work would be accepted. Comment was made on the interest which some firms were now taking in the education of their apprentices, and on the excellent system of Messrs. Cammell, Laird & Co., of Birkenhead. Mention was also made of the desirability of firms providing a library of technical books for the use of their employés.

Association of Mining Electrical Engineers.—At a meeting of the Yorkshire Branch, at Doncaster, on Saturday, a paper by Mr. V. A. Chitty on "Reinforced Concrete Poles for Transmission Cables" was read. A discussion afterwards took place.

Institute of Metals.—The annual general meeting is to be held in London (at Burlington House), on March 13th and 14th. President-Designate, Prof. Carpenter. The presidential address will be delivered. Five papers are down for reading.

Institution of Mechanical Engineers.—The annual report of the Council shows that at the end of 1917 the membership stood at 6,306, a net increase of 59. The accounts show a total revenue of £22,866 and expenditure £22,701 (including £9,943 invested for reserve funds), leaving a surplus of £165. The total assets amount to £144,319. The names of over 1,000 members have been recorded as being on active service; during the past year 22 gave their lives for their country.

The Centralisation of Electric Power.—"The Supply of Electricity for All Purposes" was the subject of an address given by Mr. W. A. Chamen before the members of the Cardiff Business Club recently. Mr. Chamen said that the benefit of adequate, efficient, and cheap supplies of electricity could not be realised unless the generation of electricity for all purposes was grouped together into a few centres where large and highly-efficient power stations could be erected. A large amount of capital was sunk in municipal as well as in company undertakings, and if the centralisation of electric power production was to be realised, it obviously became necessary to find some means by which the company and the municipal interests could be brought together. The municipality on the one hand, and the electric lighting and power companies on the other, together with the general public as a whole, would all eventually benefit by this centralisation. To continue as they were at present simply meant keeping up the price of electricity for an unlimited time above what it need be, and that without real advantage to anybody concerned.—*S. Wales Daily News.*

Wages in the Gas Industries.—Representatives of the gas industries, municipal and otherwise, and of the workers in gas undertakings, met Sir George Askwith at the Ministry of Labour, on February 21st, to discuss the questions of wages and conditions of employment. The proceedings lasted for two-and-a-half hours, and were adjourned till yesterday, no decision having been arrived at.—*Times.*

L.C.C. Employés.—Wages Awards.—Among recent awards by the Committee on Production and the Special Arbitration Tribunal is the following (quoted from the *Times*) relating to London County Council employés (main drainage, fire brigade, asylums, and highways services):—(1) Hammermen and engineering labourers working as mates to fully qualified engineers, electrical fitters, and boilermakers; and (2) men in the Engineering Department of the Fire Brigade, the war wages advances granted to engineering and foundry trades: all other workmen such advance as will make their aggregate war wages advances up to 16s. per week.

Inquiry.—The address of "Messrs. O. G. & Co.," makers of the "Acme" vibrator, small motors, &c., is asked for.

Whist Drive.—The Bury Corporation electricity department employés held a whist drive and dance in aid of the Lancashire Fusiliers' Prisoners of War Fund. Mrs. S. J. Watson, wife of the borough electrical engineer, distributed the prizes.

Demobilisation Problems.—The General Council of the National Alliance of Employers and Employed is calling for the setting up of a Central Statutory Board representative of employers and employed to regulate and supervise the reinstatement in normal employment of civilian workers now in Government or controlled establishments, the reinstatement in civil employment of the present Forces, and any general redistribution of labour arising out of the war. Mr. F. Huth Jackson recently said that the Ministry of Munitions, which was the biggest employer of labour in the country, was not included in the recent announcement on the matter made by the Minister of Labour.

Already the Government is, for several reasons, brought right up against the problems of demobilisation of munition workers even while the end of the war is quite out of sight. Its experience on this limited scale brings home at once the urgent need for seeing that plans are made well in advance of that immense demobilisation of labour which must take place when the war ends and the transfer which must follow the return of the soldiers to their former places in the workshops. There have been various reports in the papers during the past ten days which show that we have a sufficiency of certain munitions to last for more than 12 months, and as the bringing in of food from America involves cutting down the supplies of raw materials for those particular lines of munitions, there will be a slowing down in a number of the factories, at any rate for a time. Shipbuilding, aeroplane, and some other special classes will not be interfered with in this way. In the House of Commons on Tuesday, Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, referred to the manner in which the Government was handling present labour demobilisation. We quote from the *Times* report :—

"The problem of the discharges of women munition workers could not be dealt with solely on economic lines. It might be said, for instance, that the limited production which had now become necessary should be concentrated in those factories where it could be most cheaply turned out. That was a policy one would wish to adopt if the times were normal, but it was not a policy which a man in the responsible position of Minister of Munitions would in these grave times care to enforce too rigidly. In a time of war the country could not afford to have large numbers of unemployed and discontented people if there were any means by which it could be avoided. The problem had to be mitigated by a number of ameliorative measures. They could see that the men and women it was found necessary to discharge were discharged in such areas where there was the best chance of their getting immediate work. They could extend the time of contracts. Instead of holding a contractor to his engagements to produce a million shells in six months, they could give him 12 months to do it in. They could also abolish overtime, Sunday work, and night shifts. He did not say it was desirable to do all, or any of those things, but all, or any of them, might be done if necessary, in order to prevent distress arising from the reduction of their programme of production. If he did not go as far as many members could wish, it was because he had in mind that steps taken now in connection with this limited and experimental demobilisation might carry us far when the time came for carrying out the general demobilisation after the declaration of peace. No one appreciated more highly than he did the magnificent services which the women munition workers had rendered in making our Armies the best equipped Armies in the world. He would be the last man to cause hardship to the women munition workers by a soulless application of the policy of reduction in output. It was because of the splendid work of those women that our reserves were so enormous that we could face this reduction caused by a limitation of material without fear as to its military effect. So far as he was able to influence the policy of the Ministry, it would not be guided exclusively by financial considerations, and, particularly, they should not forget the debt of gratitude they owed to the women munition workers."

In answer to a Parliamentary question, Mr. Kellaway says that the number of women munition workers who have been dismissed or received notice of dismissal during the last three weeks as a result of the termination of certain contracts is about 8,000. He regrets that a certain amount of hardship is inevitable, but everything that can properly be done will be done to reduce the hardship. There are openings for a considerable number of women in agriculture, in shipyards, and in other occupations. The machinery of the labour exchanges and of the National Service Department is being utilised to its fullest capacity in order to bring the women who may be displaced into these other forms of national service. The possibility of giving priority in employment on war work to these women is under discussion. The suggestion that the Minister should authorise the issue of free railway warrants home is receiving sympathetic consideration. Other suggestions—*e.g.*, the payment of wages for a certain period—are being examined by the Departments concerned in conjunction with the Treasury. An Inter-Departmental Conference was held on Tuesday by the President of the Board of Trade, the Chairman of the War Cabinet Committee on Unemployment, to consider these and other aspects of the problem.

Niagara Power Commandeered.—The International Railway, Buffalo, N.Y., will be affected by an order of the War Department seizing all of the electrical energy produced, imported, and distributed by the Niagara Falls Power Co., the Hydraulic Power Co., and the Cliff Electrical Distributing Co., Niagara Falls, N.Y. There will be a complete redistribution of electric power among industries in Western New York, so that war industries will have all the electric power they need. The railway will be forced to rely largely upon its steam-generated power. Fortunately, the railway steam plant has been held in reserve in case of a breakdown in the Niagara Falls power.—*Electric Railway Journal.*

The New Electroculture.—Writing in the *Daily Mail* this week, Dr. F. Chamier puts forward remarkable claims for a system of electroculture which involves the use of buried wires and electrodes, supplied with current which is "intermittently high tension and continuous" for a few hours every two to six weeks. As the result of this treatment applied to crops, the yield is said in some cases to have been quadrupled. Only 10 per cent. of the fertilising material at present employed is required and sour land can be made sweet and fruitful. A dilute solution of picric acid is applied to the soil in connection with the process. Seed is also subjected to "small doses of high-frequency current" with great effect upon its germinating powers.

We would not discourage any inventor from experimenting in this field, nor do we suggest that the overhead discharge is the only possible method of stimulating the growth of crops ; but we must confess that the claims put forward by Dr. Chamier will need the strongest support by actual demonstration before we can accept them as worthy of credence. Such methods as he advocates have hitherto given disappointing results in the hands of various investigators, and, in view of the infinitesimal proportion of the current flowing between electrodes a considerable distance apart, that would pass through the soil near the surface, and the infrequency of the application to boot, we can only regard his method as comparable in intensity to homœopathic treatment, and affording little ground for anticipating noteworthy results.

Nitrogen from the Air.—President Wilson has signed an order authorising the construction of a water-power plant at Muscle Shoals (Alabama) as part of the $60,000,000 project for the fixation of atmospheric nitrogen for use in the manufacture of munitions and fertilisers.

The Manchester Meeting of the I.M.E.A.—The preliminary programme is issued of this year's Convention of the Incorporated Municipal Electrical Association, which is to be held at Manchester on June 20th and 21st. The meetings will be held in the Council Chamber of the Town Hall. No invitations will be issued to visitors on this occasion. The programme is, of course, at present subject to revision, but, as far as can be foreseen, it will be as follows :—After the welcome by the Lord Mayor on the morning of Thursday, June 20th, Mr. S. J. Watson, the borough electrical engineer of Bury, will deliver his presidential address, and a discussion on "The Future of Electric Power Supply" will follow. In the afternoon there will be visits to the works of the British Westinghouse Co. at Trafford Park, and of the Manchester Corporation Electricity Department (Stuart Street power station). On Friday the discussion on electric power supply will be resumed, and the annual general meeting will follow.

U.S. Ordnance Base in France.—The American Ordnance Base Depôt, which is now being built in France for the repair and salvage of ordnance material, will cover an area of over 2½ million sq. ft., and will accommodate several thousand employés, requiring about 8,000 KW. of electrical apparatus.

Linking-up in California.—For the period of the war, and in the interest of fuel economy, the Pacific Gas and Electric Co., the Great Western Power Co., the Sierra and San Francisco Power Co., and the Universal Electric and Gas Co. have agreed to operate their systems under one management. Under this plan several stand-by plants can be shut down without endangering continuity of service as provided by the joined systems. By operating only those centrally located stand-by plants whose efficiency is highest, a great saving of fuel oil will be effected, and loads will be distributed so that water storage on each system can be used to maximum advantage.

The unified service will be continued as long after the war as such action may be deemed to be in the interest of the public. The combined systems serve about 40,000 sq. miles, believed to be the largest area yet administered by a single management. The total generating capacity of the combined system at present is about 377,600 KW., of which 240,000 KW. is hydro-electric power and the remainder steam.

The immediate requirements for 1918 of the four chief power companies supplying the San Francisco Bay region call for an increase of more than 200,000,000 KW.-hours of energy and more than 50,000 KW. peak capacity, as compared with 1917. The future growth in power requirements of the companies operating in the Bay region will necessitate the expenditure of over $5,000,000 annually to provide generating plants and transmission lines alone to meet the demand.—*Electrical World.*

Appointments Vacant.—Draughtsman (£190) for the Sunderland Corporation electricity department ; electrical fitter (40s. + 14s. + 12½ per cent.) for the City of Chester electricity works ; shift engineer (£3 + 12½ per cent.) for the Radcliffe U.D.C. electricity department ; charge engineer (£160 +) for the City of York electricity department ; switchboard attendant for the Borough of Nuneaton electricity department ; engine driver (40s.) for the Tunbridge Wells Borough electricity works ; clerk for Rotherham Corporation electricity department ; meter tester (£3) for the Borough of Salford Electricity Departments ; electrical engineers, wiremen, fitters and engine drivers for the Southern Command power stations ; electrician (depôt foreman) for the Borough of Dover Tramways Department. See our advertisement pages to-day.

Concert.—The eighth annual concert organised by the Southport Corporation Tramways and Electricity Employés' Social and Athletic Society was held last week. The proceeds were devoted to the wounded and disabled members of the tramway and electricity depôts and the Southport Infirmary.

The Tramways Committee.—The Tramways (Board of Trade) Committee has removed to No. 8, Buckingham Gate, Westminster, London, S.W. 1 (Telephone, Victoria 6200; Telegrams, Trambotcom Sowest London), and all communications, in future, should be addressed to the Secretary, Mr. J. N. Wilson, at that address.

OUR PERSONAL COLUMN.

Central Station and Tramway Officials.—Included in the recommendations for increases of salary to be brought before the Leeds City Council at its meeting on Wednesday were the following:—Mr. C. N. Hefford, manager electricity department, £800 to £1,000; Mr. J. Burbidge, electrical engineer for the tramways department, £500 to £550; Mr. W. T. Green, assistant manager in the electricity department, £475 to £525; and to Mr. A. Daggett, traffic superintendent in the tramways department, £345 to £400.

The salary of the electrical engineer at Fleetwood is to be increased by £25 per annum.

The Huddersfield T.C. has approved by a majority the recommendation to increase the salary of the tramways manager (Mr. R. H. Wilkinson) from £500 to £600.

The Halifax T.C. has been recommended to increase the salary of the electrical engineer (Mr. W. M. Rogerson) from £700 to £800, and that of the tramways engineer (Mr. J. W. Galloway) from £325 to £375.

Mr. John Lloyd, for nearly 40 years general manager of the Southport Tramways Co., Ltd., who has retired, has been presented by the staff and employés with a gold watch and chain and an illuminated address, and a case of brushes from the Birkdale Electric Supply Co., Ltd., with a silver dressing case for Mrs. Lloyd.

The Burton-on-Trent T.C. has advanced the salary of the electrical engineer (Mr. Hall) from £400 to £500 a year.

The Dover Corporation Tramways Committee has recommended the appointment as manager of Mr. E. H. Bond, the present works superintendent, and that his salary be increased to £4 per week.

Mr. E. Carden, late manager of the Corporation tramways at Dover, has been presented by the staff with a silver cigarette case.

General.—Mr. W. G. Wickham, H.M. Trade Commissioner in South Africa, is expected to arrive in this country in April on an official visit. Firms who desire to interview him may do so in London at the offices of the Department of Overseas Trade for several weeks soon after Easter. He will subsequently visit the provinces. Applications for appointments for interviews should be made as soon as possible to the Comptroller-General of the Department, 73, Basinghall Street, E.C. 2, quoting reference number D.O.T. 2,873/18.

Mr. H. Garstang has been nominated by the Executive Committee of the Blackburn Chamber of Trade to represent the electrical trade on an employers' panel for assisting the Advisory Committee in difficult cases of substitution.

Mr. H. D. Wilkinson has removed from Queen Street Place to offices at 56, Victoria Street, S.W. 1.

Mr. E. Kilburn Scott has been appointed consulting engineer to the British American Nitrates Co., of New York. Mr. Scott left England in January to deal with the exploitation of his patents for manufacturing nitrates electrically, and will be in America for some time. His present address is c/o the British American Nitrates Co., 299, Broadway, New York.

Roll of Honour.—Wireless Operator Gilbert Lambert, R.N.V.R., formerly on the staff of the Folkestone Electricity Supply Co., Ltd., was killed in the naval raid in the Straits of Dover on February 15th.

Wireless Operator C. S. Harrison, killed whilst serving on a drifter in the raid on the Dover patrol, on February 15th, was before joining the Forces a student at the Royal Technical Institute, Salford, where he gained the diploma in electrical engineering.

Bombardier K. M. Street, electrical engineer, has gained the Military Medal for bravery, and on account of serious wounds is to be discharged.

Company Quartermaster-Sergeant Wm. Aspin, East Lancashire Regiment, who has died at home from bronchial pneumonia, was on the staff of the Blackburn Corporation tramways.

Private G. Trevassa, Devon Regiment, who was prior to the war engaged at the Newton Abbot electricity works, has fallen in action.

Private A. P. Goddard, Toronto Regiment, formerly engaged at the Tunbridge Wells Corporation electricity works, has died after being buried by a shell, and after the amputation of a leg.

Private J. T. Mawson, who has been wounded, is an electrical engineer who, having been at the Vulcan Motor Works, took up an appointment with the British Columbia Electric Railway Co., which he held for six years.

Sapper T. Mawdesley, R.E., aged 35, has been drowned by the sinking of the *Aragon*. He joined the Army in November last, while employed as electrician at Rufford Hall.

The French Legion of Honour has been won by Private A. J. Bailey, Manchester Regiment, formerly employed on the Manchester Corporation tramways.

Lance-Corporal H. Cooper formerly a motorman on the Ashton-under-Lyne Corporation Tramways, has been awarded the Croix de Guerre, with bar, the Legion of Honour, and the Medaille Militaire for deeds of great gallantry. On Friday the Mayor of Ashton handed him a gold watch from the members of the Ashton Swimming Club.

Company Sergeant-Major W. Woods and Regimental Sergeant-Major G. Imisson, York and Lancaster Regiment, both of whom were on the staff of the Sheffield municipal tramways, have been awarded the Belgian Croix de Guerre for valour. The latter already possesses the Distinguished Conduct and Military Medals.

Obituary.—Mr. James Mitchell Hewitt, consulting engineer of Hale, near Altrincham, joined the Manchester express for London on Monday evening. His dead body was found on the railway between Matlock and Darley Dale Station, but Manchester reports state that there was nothing to show how the mishap occurred. Mr. Hewitt was 60 years of age.

The death occurred on February 17th of Mr. Edward Alan Christian, electrical engineer, formerly on the staff of the Manx Electric Railway Co. and the Mersey Railway Co. He was 38 years of age.

REVIEWS.

Electrical Equipment. By H. W. Brown. London: Hill Publishing Co. Price 12s. 6d. net. Pp. 229, + xiii; 109 figs.

There can be but little doubt that hitherto there has been a considerable gap between the general electrical text-books and the highly specialised works each dealing with a particularly detailed subject. Electrical pocket books have to a limited extent filled the void, but the volume now under consideration is one which will appeal strongly to many beside those for whom it is specially written. It is pleasing to find in one cover a practical account of the equipment required in a works, presented in such a manner that it should be possible for even a tyro to follow it, though it must be admitted that there are sections which appear to be needlessly involved; at the same time, it must be remembered that the author is catering for American conditions, and in many cases the English requirements are totally different; but if the book is read and followed with an up-to-date pocket-book, there should be no difficulty in picking out those portions which would apply to modern practice in this country.

In the introduction, penned by the Head of the Electrical Department of Cornell University, it is explained that the work is based upon notes prepared by Mr. Brown to guide the student in his work, which is so mapped out as to prepare him for the more practical side of electrical engineering. In this respect the courses of instruction of our own universities are distinctly lacking; for, although they aim at giving the student a practical insight into the profession, they do not impart such knowledge as will enable him thoroughly to appreciate the working details required in actual installations, nor do they inculcate that commercial spirit which is met with as soon as he enters an office or works. "Electrical Equipment" covers these points in an admirable manner, and should do much to assist in this respect. Beyond this, it should enable works managers and mechanical engineers, who may have under their care an electrical equipment, to grasp essentials much more readily than any other work we know of. When extensions are required, a perusal of its pages would be of immense help, and possibly preliminary facts and figures could be put forward with far less trouble than if they were without its aid. Throughout the pages references are made to standard American books, and to an English reader the work suffers somewhat in this respect, but we hope that the publishers will see their way to produce a British edition at a date when the prices of materials are more settled than at the present moment.

In the first chapter the use of diagrams is explained, and many hints regarding their preparation are given. The next chapters generalise on the requisites of power plants and the choice of system; they make interesting reading, but in many cases in this country there is not much choice possible, and the user is obliged to take what is offered unless he is willing to introduce his own plant, and even then there may be local considerations which will put out of court the arguments set out in this book. The chapters on D.C. motors, A.C. motors, converters, and transformers are comprehensive without being laboured, giving just that information which will be found essential in understanding their possibilities and limitations. There are statements which are open to question; for example, "The best voltage (D.C. motors) for industrial plants is generally 220 volts; but if no motors are over a few hundred feet from the generator, 110 volts may be used." Regarding transformers, the information given should be of very great help to the works engineer.

The subject next dealt with is that of storage batteries, special mention being made of their application for portable service. A chapter on illumination follows, the topic being treated in a short but practical manner. D.C. transmission and distribution systems are next discussed, and here one is struck by the thorough manner in which the points are dealt with from both the electrical and commercial points of view; the tables which, in addition to the usual data, give approximate costs are, of course, American, but could easily be adapted to British needs. When we arrive at the question of A.C. transmission, however, the context becomes somewhat more technical, as might be expected, and while the student fresh with theory will no doubt easily peruse the matter, the practical man will be apt to flounder. The next two chapters on generators (D.C. and A.C.) are of considerable interest, and the impression is gained that the author has gone to a very great trouble to convey a large amount of general information in as small a compass as possible. It is this which tends to make the work so valuable. Regulating transformers and instrument transformers comprise the subjects following, and here much that is usually hidden away in a highly specialised and technical work is set forth. Similarly, the information regarding the controlling and regulating equipment, circuit breaking equipment, lightning arresters, and measuring and indicating apparatus is presented in a manner which should appeal strongly to those who have control of such apparatus.

The subject of motor applications is well handled, and it is hoped that the empirical formulæ which are given regarding horse-power will be even further extended when a new edition of the work appears; this chapter, together with the chapter on costs, is novel, and should do much to enable the student to appreciate the practical and commercial side to a greater extent than is usually met with at present, and they should also be of assistance to those contemplating extensions and wishing to put before their superiors the electrical end of the question without calling for outside help. If the student intelligently works through the problems with which the text concludes, he will be better able to understand the why and wherefore of the subject, and when, in every-day life, he comes in contact with the materials discussed, he will be in a much more favourable position to appreciate its use.

We feel sure the book will have the success it deserves, and will do much to increase the efficiency of thought and action of the beginner in power station and works experience; it should assist those whose practical train of thought is more developed, while it will also prove a handy volume of reference for those whose work does not demand such a first-hand knowledge of electricity as the others possess.

Power Wiring Diagrams. By A. T. Dover. London: Whittaker & Co. Price 6s. net. Pp. 208.

The first glance at Mr. Dover's book makes it quite evident that it cannot be exhaustive. A book of 208 pages suitable for the pocket cannot contain more than a fraction of the possible standard power wiring diagrams, without mentioning innumerable minor variations to suit special circumstances.

On the whole, Mr. Dover has made his selection fairly representative, though he has certainly included too many diagrams and illustrations of the manufactures of one particular firm. About 40 per cent. of the total illustrations are of a general character, not specially applicable to any maker. Of the remaining illustrations, nearly one-half show details of apparatus made by one firm, and about another 20 per cent. of these named illustrations are confined to a second firm. No other firm's goods have anything like as many, and the result is rather unfair to those who are but slightly represented, or are not represented at all. It is probable that war-time conditions are largely responsible for this state of things, but in future editions it would be desirable to hold a more even balance between the claims of various makers.

It would be obviously impossible to include all the diagrams of power-wiring connections that are called for from time to time. At first sight many of the special diagrams shown would seem to be unnecessary, as makers always send out such diagrams. These, however, have a habit of being mislaid when most wanted, and there is no doubt that a pocket-book containing such information will be of considerable value to many engineers. Certain sections might be extended, as, for example, that dealing with lifts, which has only two diagrams of lift controllers on D.C. work, and none at all for A.C. supply. The section dealing with accumulator work also is not very complete.

It must have been, however, an almost impossible task to select the most representative diagrams, and it is probable that future editions will show the need of considerable expansion in the size of the book.

The contents are divided up in very convenient sections, details of which are summarised fully in the table of contents, whilst a very complete index is added at the end. The list of conventional signs adopted is also very clear, and a special word of praise is necessary for the diagrams, which form a large proportion of the illustrations and which are exceptionally distinct. The letterpress is well written, and enables the diagrams to be followed without difficulty, whilst also giving much useful information as to the needs for certain switchgear and control apparatus.

NEW COMPANIES REGISTERED.

Oldham Rubber Mills, Ltd. (149,693).—Private company. Registered February 22nd. Capital, £2,000 in £1 shares. Manufacturers of and dealers in substitutes for leather, rubber, gutta-percha, oil-cloth, linoleum, steam and electric packing, manufacturers of articles in which such substitutes are used (including clothing), &c. The subscribers (each with one share) are:—L. Nicholas, 19, Castle Street, Liverpool, chartered accountant; H. H. Tattersall, 21, Bouverie Street, Liverpool, accountant's clerk. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Solicitors: [illegible], Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Ferranti, Ltd. (83,718).—Capital, £130,000 in 60,000 pref., 60,000 ord., and 10,000 def. shares of £1 each. Return dated January 11th, 1918. 53,374 pref., 60,000 ord., and 10,000 def. shares taken up; £123,374 considered as paid. Mortgages and charges: £124,815.

Gosport & Alverstoke Electric Lighting Co., Ltd. (82,633).—Capital, £5,000 in £10 shares. Return dated December 28th, 1917. All shares issued; £5,000 paid. Mortgages and charges: Nil.

Keynsham Electric Light & Power Co., Ltd. (64,634).—Capital, £[illegible] in £1 shares ([illegible] pref. and 2,000 ord.). Return dated January 1st, 1918. All shares issued; £6,000 considered as paid. Mortgages and charges: £2,580 (excluding interest).

Imperial United Lamp Co., Ltd.—Mortgage dated January 24th, 1918, to secure £11,000 and a bonus not exceeding 10 per cent., charged on land at Osmaston, Derby, and the company's undertaking and general assets.

A. Vernon Ward (Hove), Ltd.—Memorandum of satisfaction in full on January 26th, 1918, of debentures dated February 16th, 1917, securing £500, has been filed.

Siemens Bros. Dynamo Works, Ltd.—Debenture dated February 1st, 1918, as collateral security for £690,000, part of £1,300,000 debenture stock secured by trust deed dated January 15th, 1918, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £200,000 debenture stock covered by deed of 1907). Holder: Public Trustee.

Electrical Contracts & Maintenance Co., Ltd.—Memorandum of satisfaction in full on February 12th, 1918, of debentures dated June 25th, 1917, securing £3,000, has been filed.

East India Tramways Co., Ltd. (74,457).—Capital, £100,000 in 15,000 pref., 35,000 ord., and 50,000 def. shares, all of £1 each. 7,476 pref., 33,433 ord., and 50,000 def. shares taken up; £1 per share called up on 7,476 pref. and seven ord.; £7,489 paid, including £6 on 24 pref. shares forfeited. £83,426 considered as paid on 33,426 ord. and 50,000 def. Mortgages and charges: Nil.

CITY NOTES.

St. James's and Pall Mall Electric Light Co., Ltd.

Mr. W. Leaf, presiding at the annual meeting on Tuesday, said that the report was highly satisfactory, showing increases in revenue, profits, and dividend. The output had increased by over 700,000 units, and the revenue by over £17,000, largely from the 10 per cent. addition to charges to consumers. Cost of generation rose by £7,000. They were increasingly dependent upon the Central Electric Supply Co. Whereas in 1916 they took from that source roughly 20 times as much current as they generated themselves, in 1917 they took nearly 30 times. They generated just over 500,000 units, and purchased about 15,000,000. The Central Co. was the backbone of their own and the Westminster Co.'s business, and they had every reason to congratulate themselves upon the establishment of the joint system. A large turbo-generator was now in course of erection in place of the one that they had on order over a year ago, when it was requisitioned by the Government. The loss of the set for the winter's load prevented the saving in coal consumption that they intended, but they got through without strain. They had also been able to maintain their large winter stock of coal; the chief difficulty lay in handling it for the largely increased output. The cost of the new unit and of some important additions at Grove Road would involve capital expenditure which would be met by a loan from the two parent companies. In regard to the future, the outlook was not particularly rosy. The exceptionally mild weather this winter compared to last had reduced their revenue from electric heating; "Summer Time" had been extended by about five weeks; and there was an increase in expenses. There would be further advance in the price of labour, coal, and other materials, and the total expenditure would probably increase by from £10,000 to £12,000. For these reasons they were carrying forward a larger balance than usual, and notifying consumers of a further advance in charges of 10 per cent. as from the end of the March quarter.

Liverpool Overhead Railway Co.—At the annual meeting, on Tuesday, the chairman, Mr. H. C. Woodward, referred to the sudden death of the secretary, Mr. W. H. Alexander, who had been associated with the company since its formation, over 25 years ago. The passengers carried showed a decrease of 65,306 on the year. The total expenditure on railway and tramway was £85,406, an increase of £12,012, due to the higher cost of coal and all other stores and materials, and the additional war bonus to the employés. During the past 12 months the war bonus paid was about £13,000, and it was estimated that in the present year it would amount to £20,000. They carried last year 3,400,000 more passengers than in 1913, with about the same train mileage, and this larger traffic had considerably taxed the accommodation of their rolling stock, particularly at certain times of the day. They ran a two minutes' service in the busiest hours, which was as much as could be done with safety, but even then there was some congestion. The difficulty of obtaining necessary supplies, even at very high prices, naturally added to the anxieties of the general manager and his colleagues

W. T. Henley's Telegraph Works Co., Ltd.—In a circular issued to the ordinary shareholders, the directors state that the time has arrived for the conversion into a separate organisation of the factory and business of solid and pneumatic motor tires, which was created a few years ago as a branch of the business.

The tire business was established by means of the capital furnished by undivided profits of the company, and the business has met with considerable success, the products of the factory already having obtained a good reputation, and the directors consider that there is every prospect of the business continuing to improve after the close of the war.

It is proposed to form a tire company having a share capital of £200,000, which is approximately the amount of capital that the company is employing in the tire business. The whole of the shares in the tire company will be held by Henley's company, who will thus retain the entire control of the business. The directors considered the possibility of distributing among the shareholders by way of bonus, the whole or part of the shares in the new tire company, but they came to the conclusion that such a course would not be in the interests of the company, as the control of the tire company might in time be divorced from the parent company. As, however, the directors consider that the time has arrived when the capital of the company should be made more nearly to represent the capital actually employed in the business, they have decided to recommend the shareholders to increase the ordinary share capital by £200,000, making it £400,000, and to distribute as a bonus the additional capital of £200,000 amongst the shareholders in proportion to their holdings. Very considerable reserves have been created from undivided profits, which reserves have been largely employed by the company in trading, including, as stated above, the establishment of the tire factory, and a part of these reserves will be used to pay up the new shares.

The directors also propose to recommend that the ordinary shares of £5 each shall be divided into five shares of £1 each.

The proposals are subject to the consent of H.M. Treasury.

National Electric Supply Co., Ltd.—At the meeting, at Preston, on February 20th, Mr. J. Booth said the year had been one of increasing expenses and considerable anxieties for all electric supply companies. Considerable economies had been effected by the new steam turbine generator, but wages and salaries were considerably higher. Practically as much was paid on account of rates and taxes last year as the shareholders received in dividends. The basis on which the company was assessed was most unfair, when compared with undertakings which were in the hands of municipalities, and which got the benefit of high assessments in the increased amount of rates. Efforts were being made to remedy that matter, for, as a result of the assessment at the present time, consumers were having to pay a higher price for electric light and power than would otherwise be the case.

Northampton Electric Light & Power Co., Ltd.—During 1917 operations have included important developments. The new riverside works have been delayed in consequence of labour shortage, and delays in steel and other materials. Total connections equivalent to 260,247 lamps (32 watts). New connections 17,394 (equiv.). Large increase in heating and cooking stoves. Motors increased from 5,144 to 5,475 h.p., of which 3,795 are let out on hire. Units sold increased by 11.3 per cent. 14,000 shares issued in November largely oversubscribed. After paying pref. dividend, putting £6,450 to depreciation, and paying 6½ per cent. on the ordinary shares, £1,668 is to be carried forward.

Central London Railway Co.—At the annual meeting, Lord G. Hamilton said that they had participated in increased traffic due to the reduction in services of surface transport undertakings, but expenses had increased in equal degree, and the maintenance of the property could only be carried out with the greatest difficulty on account of the shortage of materials. They must maintain substantial reserves to meet this deferred maintenance when circumstances permitted it to be carried out. If the upward tendency of wages and prices continued they would have to make further fare increases.

British L. M. Ericsson Manufacturing Co., Ltd.—The accounts for 1917 are of an exceptionally favourable character; the company gains strength yearly. The profit constitutes a record, and future prospects are excellent. Net profit after charging £12,588 for depreciation, £8,247 for income-tax, £2,500 for debenture interest, amounts to £72,512, plus £15,072 brought forward. After paying the preference dividend, and 8 per cent., free of tax, on the ordinary shares, placing £11,000 to reserve, and £5,000 to a reserve account for extra depreciation, £57,585 is to be carried forward (subject to Excess Profit Duty).

Tyneside Tramways & Tramroads Co.—After paying the preference dividend, and 5 per cent. for the year on the ordinary, a bonus of 2s. per share, less tax, is paid on the latter, £1,400 is put to renewals, depreciation, &c., £1,000 is put to special reserve, £600 is written off balance of registration and formation expenses, and £1,312 is to be carried forward. Traffic receipts for the half-year show an increase of £6,051 compared with the corresponding period of 1916; for the whole year the increase was £11,590.

Fife Tramway, Light & Power Co.—The annual meeting was held in Edinburgh Mr. Wm. Low, the chairman, said that the Dunfermline & District Tramways paid over to the company by way of dividend and management fees £17,050, compared with £15,000 for the preceding year. The company was in a very sound position for raising additional capital when required, having power to issue £275,000 of debenture stock as and when required

Mansfield & District Tramways, Ltd.—Dividend on ordinary shares for the year 8 per cent., less tax, and £1,000 to reserve, carrying forward £1,477.

Telegraph Construction & Maintenance Co., Ltd.—For 1917 the net profit was £115,227, after charging interest on debentures. Adding £112,750 brought forward there is a total of £227,976. An interim dividend of 5 per cent. already paid is followed by a further dividend of 10 per cent., together with a bonus of 12s. per share, free of tax, absorbing £67,230. To reserve fund £20,000, £10,000 to the pension fund, carrying forward £108,336.

Metropolitan District Railway Co.—Lord George Hamilton, addressing the annual meeting, said that nearly one-half of the increase in the expenses (£609,964) was due to higher wages and the war bonus paid to the staff. In reply to criticism by Sir R. Perks, he said that during the year they had increased their rates to an extent which in a full year would bring in about £400,000 extra to the combined companies.

Rushden & District Electric Supply Co., Ltd.—For 1917 favourable progress is reported. Consumers increased from 151 to 171, and motors from 459 to 568 h.p. Units sold increased 22 per cent. Revenue from sale of current increased from £3,060 to £4,181. Dividend 5 per cent., carrying forward £136.

Ramsgate & District Electric Supply Co., Ltd.—Gross profit for 1917, including £860 brought forward, £3,438. After allowing for 5 per cent. interest on outstanding accounts due to contractors, a dividend of 3 per cent. is paid, £1,000 is placed to reserve, and £665 is to be carried forward.

Tramways, Light & Power Co., Ltd.—After paying the preference dividend and putting £7,500 to reserve, £5,277 is carried forward. Fair progress has been made, notwithstanding the difficult conditions for all such undertakings.

City of London Electric Lighting Co., Ltd.—Preference dividend 6 per cent. for the year; ordinary share dividend 16s., at the rate of 8 per cent. for the year.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Dividend of 4 per cent. on the ordinary shares for the December half-year, making 7 per cent. for the year.

STOCKS AND SHARES

Tuesday Evening.

Stock Exchange markets have subsided into a quiet and rather a dull condition. The last state of Russia is a malinfluence that begins to make itself felt in markets generally, but in spite of the various political upheavals, the appetite for industrials continues keen, and active conditions prevail amongst manufacturing shares connected with electrical work. There have been particularly sharp movements in Electric Constructions.

At one of last week's meetings of proprietors, the chairman spoke rather hopelessly of the difficulties that have arisen over transporting Londoners by underground. So great is the traffic that its handling has become a very serious problem. He spoke of a possible necessity for another revision of fares, but held out cold comfort to season-ticket holders who cannot find seating accommodation in either of the two classes. Meanwhile the quotations for the stocks show a drooping tendency. The only shaft of light thrown on the railway position is the extremely cautious hint of a possible raising of dividends heard at the recent meetings of the Great Western and the North-Western Companies.

Electric Constructions took a jump to 30s. 6d. on vague optimisms in the direction of "amalgamation"—that blessed word to which the old lady's Mesopotamia is now a bad second. There was a most unwonted excitement about the market, an excitement badly dimmed by a rush of profit-taking which reduced the price to 26s. 3d. again. British Westinghouse preference have also been strong, advancing briskly to 63s. before the reaction occurred that left them a little lower, though a fair rise remains on the week. These £2 shares are entitled to 15 per cent. non-cumulative dividend, and for some time past have received 7½ per cent. Besides amalgamation rumours, hopes are entertained in bullish quarters that the dividends may steadily approximate their full level. At the present price, the yield to a buyer is comparatively small. Other electrical industrials are firm to good, but, with holders disinclined to sell, the market is necessarily very narrow.

Supply shares keep strong. A demand for London Ordinary is something of a feature It is said in the market that one of the big provincial centres has been trying hard to obtain shares. The Government scheme for centralisation of electricity supply is making steady progress. The only change in the price list is a rise of ¼ in London Ordinary, the rest of the shares remaining hard at their previous levels

Henley's at the moment are unchanged at 17s., but in view of the scheme which the directors have just propounded for dividing the business into two parts, there are buyers only for the shares. The scheme involves a distribution to shareholders which will probably have the effect of putting the price still better, and, although something of the sort has been rather expected for some time past, the definite proposals come as a pleasant confirmation to the optimists. Callenders at 16 are 10s. up on the week. Telegraph Constructions remain at 43, unaffected by the excellent figures of the report. Crompton Ordinary and Preference are both 18s., Edison Swans remain about 33s., and other industrials in this department are noticeably good.

British Columbia Electric Preference stock has recovered 6 points to 52, and private advices from Vancouver this week give a much more satisfactory account of the condition in that city than have been reported until just lately. Canadian issues as a whole are inclined to pick up; Canadian General Preferred at 108 is a point to the good. In other colonial and foreign descriptions, there is not much change. Brazilian Tractions weakened to 44, but recovered again to 45. Manila Electric Capital stock has improved to 74½. The Mexican group remains stagnant. There has been a little buying of the 5 per cent. Debenture stock of the Anglo-Argentine Tramways.

Telegraphs are steady with the exception of West India and Panama, which reacted ⅛ after their meteoric rise. Marconis have come on offer, with the parent shares at 3 and Americans at 23s. 6d. The dulness is associated in the market with the lack of interest shown by the public in the shares for the time being. The rubber market is also dull, although the price of the produce has risen a little. Iron and steel descriptions are mostly firm, but the leading armament shares reacted to some extent after their previous buoyancy.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend		Price Feb 26, 1918	Rise or fall this week.	Yield p.c.
	1915.	1916.			
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3¼xd	—	6 13 6
Chelsea	4	8	[illegible]	—	6 4 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11¼	—	6 4 5
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅜	—	5 11 7
London Electric	8	Nil	1⅛	+ ⅛	Nil
do. do. 6 per cent. Pref.	6	4	3⅜	—	5 18 6
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	8	7¼	—	6 4 2
South London	6	5	8	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	6 10 6
Westminster Ordinary	7	7	7	—	6 8 7

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	33/6	1½	12¾	—	6 13 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	6	7	9¼	—	*7 11 4
Eastern Extension	8	8	15¼	+ ⅛	5 6 0
Eastern Tel. Ord.	8	8	152	—	*5 6 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 18 3
do. Pref. ..	6	6	10½	—	5 17 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 9
Marconi	10	15	3	— ⅛	5 0 0
Oriental Telephone Ord. ..	10	10	4⅛	—	2 17 9
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Pan	6d.	6d.	1$\frac{11}{16}$	— ⅛	*2 19 2
Western Telegraph	7	8	15½	—	*5 5 0

Home Rails.

Central London, Ord. Assented	4	4	62½	—	6 9 1
Metropolitan	1	1	22	— ¼	4 11 0
do. District	Nil	Nil	15⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	—	Nil
do do. "A" ..	Nil	Nil	5/3	—	Nil
do do. Income	6	4	80½	—	*4 19 5

Foreign Trams, &c.

	Dividend				
	1915.	1916			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	+ ⅛	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2⅛	—	—
do. 5 Deb. ..	5	5	66	—	7 11 6
Brazil Tractions	4	4	45	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	52	+ 6	9 12 4
do. do. Preferred	Nil	Nil	30½	—	Nil
do. do. Deferred	Nil	Nil	23	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	32½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3$\frac{5}{16}$	—	4 10 4
British Aluminium Ord. ..	7	10	1$\frac{21}{32}$	—	6 0 9
British Insulated Ord.	17½	20	3¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	3⅛	+ $\frac{3}{16}$	4 5 10
Callenders	20	20	16	+ ½	6 5 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3$\frac{9}{16}$	—	5 12 2
Edison Swan, fully paid .	—	—	2⅝	—	Nil
do. do 4 per cent Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅜	+ $\frac{1}{16}$	5 9 1
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19½	—	5 2 7
Henley	25	25	17½	—	7 2 10
do. 4½ Pref.	4½	4½	4	—	5 12 3
India-Rubber	10	10	14¾	—	*6 15 7
Telegraph Con. ..	20	20	43	—	*5 11 9

* Dividends paid free of Income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 27th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/6	..
a	Ammoniac Sal	per ton	£75	..
a	Ammonia, Muriate (large crystal)	„	£72	£4 inc.
a	Bisulphide of Carbon	„	£23	..
a	Borax	„	£38	..
a	Copper Sulphate	„	£67 10/-	..
a	Potash, Chlorate	per lb.	2/6	..
a	„ Perchlorate	„	2/-	..
a	Shellac	per cwt.	£22 10/-	£3 15/- inc.
a	Sulphate of Magnesia	per ton	£16	..
a	Sulphur, Sublimed Flowers ..	„	£35	..
a	„ Lump	„	£25	..
a	Soda, Chlorate	per lb.	1/-	..
a	„ Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c	„ Tubes (solid drawn) ..	„	..	..
c	„ Wire, basis	„	..	
c	Copper Tubes (solid drawn) ..	„	1/7 to 1/7½	½d. inc
g	„ Bars (best selected) ..	per ton	£147	..
g	„ Sheet	„	£147	..
g	„ Rod	„	£147	..
d	„ (Electrolytic) Bars ..	„	£125	..
d	„ „ Sheets ..	„	£152	..
d	„ „ Wire Rods	„	£133	..
d	„ „ H.C. Wire	per lb.	1/3⅞	..
f	Ebonite Rod	„	3/-	..
f	„ Sheet	„	2/6	..
n	German Silver Wire	„	2/3	..
h	Gutta-percha, fine	„	6/10	..
h	India-rubber, Para fine	„	2/8	1½d. inc.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	„ Wire, galv. No. 8, P.O. qual.	„	£42	..
g	Lead, English Pig	„	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e	„ „ „ medium	„	8/6 to 6/-	..
e	„ „ „ large ..	„	7/6 to 14/- & up.	..
d	Silicium Bronze Wire	per lb.	1/8½	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	„	..	..
n	„ Wire, Nos. 1 to 16	per lb.	4/1	..

Quotations supplied by—

a	G. Boor & Co.	*g*	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	*h*	Edward Till & Co.
d	Frederick Smith & Co.	*i*	Bolling & Lowe.
e	F. Wiggins & Sons.	*l*	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*n*	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

Adjustment of Wages.—At a meeting of the Conference Club (an organisation of large U.S.A. electrical contractors doing an inter-State business), the feature of the programme was a paper on a plan for the automatic adjustment of the wages of labour, by Mr. L. K. Comstock. His proposal related to the periodical adjustment of wages on the basis of the "index numbers," compiled by various authorities, showing the rise in the prices of commodities that make up the cost of living. Assuming that three-quarters of the wage-earner's outlay for the necessities of food, clothing, and shelter follows the trend of these index numbers, Mr. Comstock suggested that if, for example, the accepted index number for April 1st, 1917, was 190, and it rose to 220 by October 1st, 1917, an increase of 15 per cent., a corresponding increase should be granted on three-quarters of a given worker's wage. Such adjustment would preserve his relative earnings unchanged, compared with the rising cost of living. Such a plan of adjusting wages had the merit of immediate practicability. For years the United States Department of Labour had compiled and published an index number which would serve every purpose, while having the stamp of authority. Mr. Comstock urged that both the employer and mechanic frankly admitted that neither could get along without the other, and asked that, making a virtue of necessity, the employer should study sympathetically the needs and requirements of his men, and, likewise, that the Union should see to it that its men worked faithfully and sympathetically for their employers.—*Electrical World.*

Work for Men Blinded in War.—A form of occupation ideally suited for sightless men is being developed by the Crocker-Wheeler Co. at its plant in Ampere, N.J. Coils for armatures and similar apparatus must be wound, and no machine has been devised that will do this as well as a workman can do it by hand. The coils of wire are wrapped with tape. Millions of these wire coils are used, and their number is growing each year. Wrapping or insulating them with tape is a kind of work very similar to basket weaving and chair caning.

A workroom started about two months ago has already brought happiness into the lives of a group of blind men and women. They have learned to do the work, and have almost attained the speed of a normal worker.

When these are proficient they will return to their various countries and carry on the work of making the blind self-supporting by instructing the war blind.—*Electrical World.*

NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

(*Concluded from page* 172.)

The report refers to the average price charged by certain municipalities in Lancashire for supplies to tramways and for public lighting, and a statement is made that most, if not all, of these municipal undertakings are only able to supply power at reasonable prices because they make exorbitant charges for traction and public lighting. Before committing themselves to such a statement one would expect responsible engineers and business men to examine the position carefully. It did not, apparently, seem possible that although a few units were supplied, say, at 2.5d. to 3d. for public lighting, or 1d. to 1.5d. per unit for traction, the effect on the balance-sheet of the undertaking might be almost negligible, and in some cases if such units had been supplied without any charge whatever the financial result would not have been seriously affected. Then, again, with regard to the statement that the N.E. Coast companies supply their entire output at a price below an average of ½d. for E.H.T. bulk supplies, large power supplies, and a comparatively small amount of detail distribution, the Committee will be surprised to learn that some of the municipal undertakings in Lancashire are selling over 30 per cent. of their output at prices under .4d. per unit, and 60 to 80 per cent. of the output at prices under .5d. per unit, but by reason of the sales for lighting (at prices in many cases lower than those obtaining on the N.E. Coast), the average price exceeds ½d. per unit. A further point of importance arises in connection with the financial side of the business. The N.E. Coast companies have not had to obtain out of their consumers' pockets year by year the necessary means to reduce outstanding obligations to their proprietors to the same extent as the local authorities, who have reduced their indebtedness by 35 per cent. to 45 per cent. It would have been extremely interesting if a statement had been published in the report to show the capital expended on the N.E. Coast undertaking and the amount which had been set aside out of profits either by way of sums to replace obsolete plant or for reserve and depreciation, and a comparison made with the Lancashire municipalities. A comparison on these lines would undoubtedly show the municipal undertakings to be in a much stronger position than the companies, and yet, in spite of these disabilities, which necessitate a higher charge for the supply than would be required in the case of a company, many of the local authorities regularly show annual results which are much better financially than those shown by the companies.

Another important feature in the report is the general condemnation of the erection of any power station unless it is adjacent both to a colliery and a natural supply of water. It did not appear to occur to the Committee that with the exception of the N.E. Coast there is no case in the country where collieries and a natural water supply are available in the same locality. In the Birmingham district, for instance, although there are plenty of collieries there is probably not a sufficient flow of water to run more than 5,000 to 10,000 KW. without the use of cooling towers; substantially the same conditions obtain in the Sheffield, Leeds, and Manchester districts. The question might well be put to the Committee whether, under these circumstances, they recommend that super-stations should be provided, say, on the Humber, or the Mersey, where water is available for the production of the few million horse-power which would have to be transmitted to meet the requirements of the districts named, and also whether they prepared estimates to show the cost of providing transmission mains and the losses incurred in delivering such requirements into the industrial areas. Surely, they would not have condemned as "most unsatisfactory and the cause of great apprehension for the future" each and every scheme involving the use of cooling towers without constructing a practical scheme as an alternative. So far as one can judge, there does not seem the remotest possibility that the large centres of industry already established in the Midlands, where the demand for power is both large and dense, but where natural water in large quantities is known to be absent, will ever be supplied from power stations situated at any great distance. The capital cost and losses of any known transmission scheme would pay for the additional costs incurred in connection with cooling towers many times over. In the near future, also, it is quite possible that internal-combustion turbines may supersede steam turbines as the most suitable prime mover, in which case there would be no necessity to provide large quantities of circulating water. If all super-stations are to be placed near natural water there will probably be another general scrapping all round at a later date in order again to start afresh on other sites, and cut out the transmission losses.

Regarding the so-called "Power Acts" legislation, there is no particular reason to suppose "that Parliament was convinced that the supply of electricity must be dealt with in a big way." Had this actually been the case, no doubt the Government would have introduced measures which would have insisted on an enlargement of the then existing areas for generating purposes, but such a procedure has never yet been contemplated. The so-called "Power Acts" were passed at the instigation and under the auspices of company promoters who thought they saw a way of exploiting the industry, otherwise they would not have touched the business. The fact that the "Power Acts" emerged in a form "which is complicated and unworkable" is surely no fault of the municipalities, who found it necessary to protect their own interests. The fault, surely, lies with the promoters of the Power Acts, who were evidently satisfied with the powers conferred upon them, because they proceeded to erect stations and afford supplies. They knew, or ought to have known, their limitations, and if they subsequently found themselves in difficulties that is no reason why they should blame somebody else for their own errors of judgment. It is quite true that power companies have been excluded from dealing with the majority of power users because such power users were situated in areas already provided with an electricity supply scheme, but they really have no grievance on the "score of restricted sphere of operations," and "of their inability to get to work on a large scale" when the powers granted to them expressly provided this limitation. It is no more the function of a so-called power company to cater for the special requirements of industry than it is of the various local authorities; both operate under similar obligations to supply all individual consumers. The claim that municipalities have not developed the supply of energy for power purposes is also another mis-statement of fact. Numbers of cases can be put forward where the sales under this heading have increased as fast as new plant could be provided to deal with it. Records show that in many cases the output for such purposes has increased threefold to tenfold during the last decade; equal or better results cannot be shown by many companies. Many local authorities have already shown "the freedom of range and keenness which in a high degree is conducive to the fullest measure of success," although apparently such a spirit ought only to be distinctive of private enterprise.

There are many other points in the report intended to discredit the efforts of local authorities to which exception might be taken, but enough has already been said to show that many of the statements are entirely without foundation.

Although I have felt it necessary to offer criticism on certain portions of the report because of the unfairness of the comparisons made, I do not intend to comment adversely on the main conclusions arrived at by the Committee. It is undoubtedly essential that steps should be taken to improve the position:—(1) The present limited boundaries for generating purposes must be superseded by much larger areas; (2) new authorities must be set up to exercise the powers in such areas; (3) larger generating plant must be provided in specially selected positions to supply the areas at present dealt with by local generating stations; (4) the new authority must acquire and operate as one undertaking all the existing generating stations and main transmission lines in the enlarged area.

It is only by such means that individual users of electrical energy will be able to obtain a supply under the most satisfactory conditions.

I also agree with Lord Haldane's remarks that "whatever conflict there may be between the interests of the local electrical authorities which exist at present and the interests of a comprehensive scheme, there is no conflict in this matter between the interests of the local community and those of the nation as a whole." A manufacturer who requires a supply of electrical power does not really care which type of authority is responsible for such supply so long as it is given at a price which compares favourably with other alternatives and is satisfactory in other ways.

A NEW PRINCIPLE IN THE FLOW OF HEAT.*

By CARL HERING, D.Sc.

When in the usual combustion process the high-temperature flame impinges on a surface which is maintained at a much lower temperature, as, for instance, in the boiling of water in steam boilers, in cooking utensils on gas stoves, &c., the sudden chilling of the hot gases causes a very thin film of extremely high thermal resistance to form over the flame side of this surface; all the heat which flows usefully from the flame to the water must pass through this very high resistance, which means that the rate of transference of this useful heat is greatly reduced thereby, and that the usual method of boiling water is therefore a very imperfect one.

The thickness of this film seems to be of the order of magnitude of about 0.005 in. If the flame temperature is taken as about 1,350 deg. C., and that of the water is 100 deg., the drop of temperature through this film will be about 1,250 deg. C., showing an extremely high thermal resistivity.

A study of the properties of this film, by the writer, showed that its resistance diminishes greatly as the difference of temperature between its two faces is decreased. The temperature of the flame and of the water being fixed, the only way to accomplish this is to greatly increase the temperature of the fire side of the vessel This can best be done is practice by inserting between the hot and the cold surfaces of the vessel an artificial thermal resistance of such magnitude that the current of heat flowing through it will maintain the hot side at a high temperature. As the difference of temperature between the two ends of a thermal resistance is a function of both the resistance and the flow of heat (like the electrical analogy), and as the greatest possible flow of heat is what is desired, it follows that this artificial resistance should be made of the best possible heat conductor, so that its resistance may be made as low as possible; it should, therefore, be made of metal rather than of insulating materials.

The thermal relations are shown roughly in fig. 1. The ordinates represent the thermal resistances in the path of the heat flow; the abscissæ the temperatures of the flame side of the vessel. The rapidly falling curve *a* then shows approximately how the resistance of this film (or its equivalent expressed in terms of thermal resistance) falls as the temperature of that surface rises. The rising curve *b* shows approximately the thermal resistances which must be inserted to bring that heat-absorbing surface to those temperatures. Curve *c* is the total resistance—that is, the sum of the two others; it is this that governs the flow of heat from flame to water, and it will be seen to have a minimum point P beyond which it is no longer advantageous to increase the artificial resistance. Hence, by increasing this resistance the flow of heat increases greatly up to a maximum point, and then diminishes again. These curves are based on experimental results, and not on theoretical deductions, and they are only approximate, as many other factors enter also.

The greatest heat flow is obtained when the drop of temperature in the artificial resistance is made approximately equal to that in the film; this means that the temperature of the surface at which the heat enters the walls of the vessel should be about midway between the temperatures of the flame and the water, hence about 725 deg. C. (about 1,365 deg. F.), which is a dull red heat. The more this drop of temperature in the artificial resistance is due to the flow of heat and the less it is due to actual resistance, the better. As copper is one of the best heat conductors, the maximum in practice will be obtained when the artificial resistance is made of copper.

Unlike the analogous case of electrical energy, there is no loss of heat energy or efficiency in overcoming these two thermal resistances; all the calories of heat which enter the hot side issue again from the cold side (assuming perfect lateral heat insulation). The resistances therefore affect only the *rate* of transmission through a given cross-section. But indirectly the thermal efficiency in this case increases with this rate; there are always some unavoidable losses of heat, and if a given quantity of water is evaporated by the same flame in, say, half the time, these losses will take place during only half the time, hence will be halved. A distinction must therefore be made between the rate and the efficiency; the writer has succeeded in increasing the rate about 27 times, but the thermal efficiency in ordinary steam boilers is from 25 to 75 per cent., possibly even a little higher in some very good boilers, and therefore it could not be increased 27-fold, though the losses might be reduced to 1/27 of what they were, if the time of heating could be reduced that much.

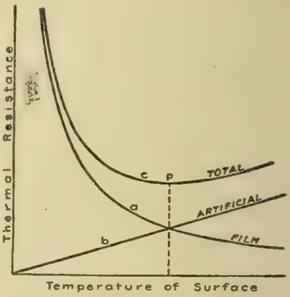

Fig. 1.—The Effect of Thermal Resistance on Heat Flow.

In practice the most convenient way to make these artificial resistances is by attaching metallic lugs to the flame side of the vessel. These must be so proportioned in diameter and length that the heat flow through them will maintain their hot ends at a temperature about half-way between that of the water and the flame, which is at about a dull red heat; unless so proportioned they will not act as described, and merely add a little to the heat-receiving surface. Such lugs, when properly proportioned, act as though they pierced thermal openings through that highly-resisting film through which the heat then rushes into the water very rapidly, as is shown by the water boiling with extreme rapidity directly over the tops of the lugs.

When these lugs are made shorter and thicker, or longer and thinner than they should be, the flow of heat diminishes, as indicated by the curve *c*. As the same thermal resistance may be obtained with short, thin lugs, or with long, thick ones, provided the ratio of the diameters and lengths is the same in both, there is a choice open. Practical considerations, such as the expense, weight, space, &c., will generally decide this.

Theoretically, the best condition would appear to be one lug of the diameter of the bottom surface of the vessel, or in other words, a very thick bottom; but this thickness (corresponding to the length of the lug) would then have to be several feet, making this form of the resistance absurdly impracticable. The other extreme would be to have innumerable very thin short lugs, close together; this is impracticable on account of the expense, the frailty of such thin lugs, and the fact that when maintained at such a high temperature they gradually burn up. Between these extremes there are mean proportions which give the best results, considering the practical conditions.

The lugs may be made slightly conical so that their bases cover practically the whole surface, while their thinner ends are far enough apart to permit the free circulation of the hot gases. When placed radially on the outside of the tubes of a water-tube boiler, they may be cylindrical, yet have their cooler ends close together and their hot ends farther apart.

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* From the *Journal* of the Franklin Institute, and *Power*, Vol. 47, No. 1. Abstract.

The former theory concerning the use of lugs on the heated surface was that they increased the heat-absorbing surface. While it is undoubtedly true that by increasing the surface covered by this film its resistance as a whole is reduced somewhat, yet the writer's researches have shown conclusively that the increased flow is by no means a function of this surface, and that the older theory is therefore quite fallacious, which no doubt explains why this frequently proposed method of increasing the rate by increasing the surface has not come into general use; the principle was not the correct one. Increasing the surface without breaking down the film may give a small percentage increase, but by breaking down the film resistance as described an increase of several thousand per cent. was obtained.

Special attention was given to this theory of the surface in the writer's researches, and many comparative tests were made; the results bore no relation whatsoever to the surface, but they were all in accord with the principle above described.

The manifold increase of flow obtained by properly proportioned lugs refers to the flow through the lugs as compared with the flow through the same area of the vessel as that of the cross-sections of the lugs, and therefore is of interest chiefly in showing the correctness of the principle. In practice this extreme result of 27-fold could not be reached, and probably could not even be very closely approached. The lugs in this case were rather far apart; when closer together the flow in each lug becomes less, but the area covered by them then becomes so much greater that the flow per square inch of total surface of the vessel is greater.

With ordinary tin cups over a quiet Bunsen flame of about the same diameter as the bottoms of the cups, and shielding the sides of the cups from the flame, the same amount of water was evaporated in nearly one-quarter of the time with nearly one-quarter of the amount of gas. If in steam boiler practice the rate could be merely doubled, it would be of great importance, as it would diminish the size of the boilers by about a half.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Wild-Barfield Furnace for Alternating-Current Working.

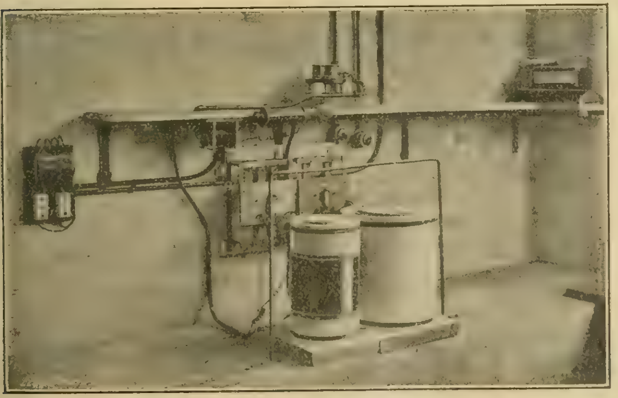

Fig. 1.—Wild-Barfield Installation for Hardening Steel; A.C. Type.

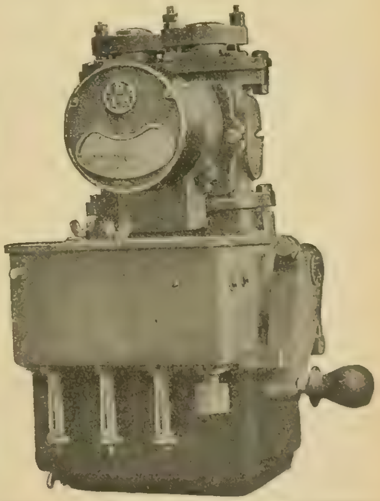

Fig. 2.—B.T.H. Ironclad Switch with Ammeter.

The alternating-current furnace is similar in construction to the continuous-current furnace, which we have already described, but differs from it only in the means adopted for obtaining an indication as to when the steel in the furnace arrives at the temperature of decalescence and is ready for quenching.

Briefly, the furnace consists of an inner crucible containing molten salt and heated by a wire helix wound on its outer periphery. This crucible is surrounded by lagging material, and is contained in an outer case, on which is wound a coil of copper wire. The heating helix and the outer coil thus constitute the primary and the secondary of a transformer.

The furnace windings are coupled up in series with the primary and secondary windings of an auxiliary induction coil or transformer. The coupling is such that the voltage induced in the furnace secondary winding is opposed by that in the secondary winding of the auxiliary induction coil.

In the secondary circuit is inserted an indicating instrument, which takes the form of a vibration galvanometer.

Before any steel article is introduced into the furnace, the voltages induced in the two secondary coils balance exactly, the galvanometer receives no current, and its "spot" remains perfectly steady. As soon, however, as a steel article is placed in the furnace the steel is magnetised by the heating winding, the total amount of magnetism passing through the secondary winding is increased, the secondary voltage is also increased, balance between this and the secondary voltage of the auxiliary induction coil is destroyed, and an alternating current is circulated through the indicating instrument, which is indicated by the spot vibrating and its image becoming confused.

As soon as the steel arrives at the temperature of decalescence it also becomes non-magnetic; thereupon conditions are restored to what they were before the steel was introduced into the furnace and the "spot" immediately stops vibrating.

It is thus known with certainty that the steel has arrived at its true decalescent temperature, and if it is withdrawn and quenched at once it will be properly hardened without being over-heated, a condition absolutely necessary for all cutting tools of the finest possible grain, and consequently the keenest and most enduring edge is thus secured.

Equally good results may be obtained once in a way by a very highly skilled workman employing other methods, but with this process no skill whatever is required, and the results obtained will be the best possible for the particular steel used, not occasionally only, but every time.

Patents have been applied for by the Automatic & Electric Furnace, Ltd., 6, Old Queen Street, S.W. 1, makers of these furnaces. Fig. 1 shows the complete outfit.

A New Electrical Alloy.

A copper-nickel alloy, which, it is claimed, replaces German silver and is permanent and non-corrosive, withstanding higher temperatures than German silver, has been developed by the Electrical Alloy Co., of New York City. This alloy is to be known as "Lucero." It is stated that it does not contain any zinc and is very useful for rheostats, car heaters, &c. The specific resistance is 290 ohms per mil-foot (48 microhms per inch), and the temperature coefficient is 0·001 per °F.—*Electrical World.*

Ironclad Oil-break Switchgear.

The British Thomson-Houston Co., Ltd., of Rugby, have developed a line of ironclad switches known as "type O, Form K," for circuits of small capacity up to a pressure of 700 volts; the type is of simple design, with quick make-and-break, and can be fitted with the usual automatic attachments. Fig. 2 shows the wall pattern, with ammeter, and clamps for armoured cable. The tripping device is of the free-handle type, and an indicator is provided to show when the switch has opened automatically. The contacts are of the controller finger type, readily renewable. A pedestal type is also made, with or without a bus-bar chamber. The maximum rating of the type is 60 amperes.

The Wilkins Truck Unloading Gear.

Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W. 1, have been appointed sole concessionaires for the United Kingdom for the Wilkins unloading gear, a device which at present is being supplied only to the Government for use in connection with road-making, but which will be useful to municipalities which own electric vehicles. It consists of a flexible platform forming the floor of the truck, which can be moved by a drum mounted below the tail-board, the drum being rotated by handles. The action is similar to that of a chain-grate stoker, and a heavy load can easily be deposited with its aid. It can be applied to existing vehicles without structural changes, and saves both time and labour. Lorry builders who wish to equip their own vehicles can be supplied with the essential parts.

Tools for Splicing Wire.

Everyone knows what a difficult job it is to splice solid hard-drawn copper or iron wire without suitable tools. In order to obtain a perfect joint, tension must be exerted on the wire ends while winding the splice, and this cannot very easily be done with the common type of cutting pliers. Fig. 3 (1) gives a clear idea of what may be done to overcome the difficulty. A $\frac{3}{16}$-in. hole is drilled in the soft part of one jaw of the pliers. Then by inserting the end of the wire to be wound and rotating the pliers, a perfect tight joint is obtained.

Fig. 3 (2) shows a wire-splicing tool that makes an excellent joint. It winds the joint tight up to the very end of the wire, a result which cannot be obtained with any kind of pliers. While the joint is being made, the other end of the wire is held by a pair of pliers. The tool consists of a piece of machine steel B, fig. 3 (3), to which a right-angle extension C is riveted. Three holes for the different sizes of wire are drilled, for holding the ends of the wire to be wound on the splice, as shown at 4. The holes for the wire should be well rounded, as shown at E, so as to give the wire a good sliding surface.—M. P. Bertrande, in *Power.*

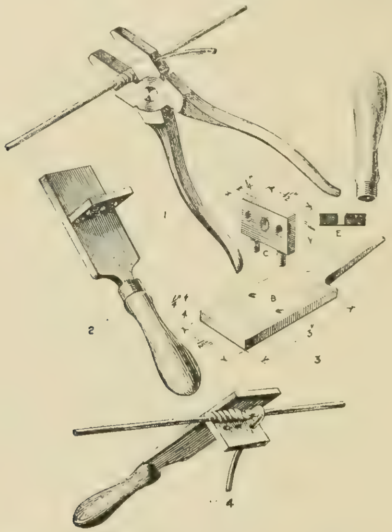

Fig. 3.—Splicing Tools, Parts and Assembly.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285 High Holborn, London, W.C., and at Liverpool and Bradford.

2,394. "Electric apparatus for heating liquids." H. C. Sanders. February 11th.

2,415. "Protection of electric supply distribution systems in which shunt wires are employed." A. V. Downton. February 11th.

2,422. "Signalling lamp." G. J. Best and Howes & Burley. February 11th.

2,484. "Electric terminal." Kelvin, Bottomley & Baird, and C. H. Wright. February 12th.

2,494. "Electric current controllers." Y. Uchida. February 12th.

2,508. "Starting devices for internal-combustion engines." F. Allison. February 12th.

2,514. "Air-cooled sparking plug." A. Gaethofs. February 12th.

2,526. "Apparatus for producing flashes by electric volatilisation of fusible wires." J. Courtier & P. Courtier. February 12th.

2,527. "Ignition devices." F. W. Vickepy. February 12th.

2,543. "Device for suppressing earth current in high-voltage systems." Allgemeine Elektricitats Ges. February 12th. (Germany, January 23rd, 1917.)

2,545. "Synchronising or controlling clocks." P. P. Andersen. February 12th.

2,549. "Centrifugal type of mercury cut-out for dynamo-electric machines." N. E. Dufty. February 13th.

2,561. "Insulators for telegraph, telephone, &c., wires." E. D. M. Scrivener, and Taylor, Tunnicliff & Co. February 13th.

2,572. "Cooling alternating-current motors." W. F. Higgs. February 13th

2,573. "Direct-current electric motors." W. F. Higgs. February 13th.

2,592. "Interrupter for electric circuits." R. Bosch (firm of). February 13th.

2,595. "Fieldless rotary transformer." P. G. Barnes & P. J. Barnes. February 13th.

2,602. "Automatic starting devices for electrically-driven air compressors and pumps." British Thomson-Houston Co. & J. Sugden. February 13th.

2,615. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. Hunt. February 13th.

2,661. "Sparking plugs for ignition." A. E. Heath. February 14th.

2,664. "Electric motor control systems." J. J. Ash & British Thomson-Houston Co. February 14th.

2,674. "Practice buzzer sets." A. C. Brown. February 14th.

2,676. "Electric conductors." G. Fuller and Fuller Wire & Cable Co. February 14th.

2,685. "Electric selective switching systems and apparatus." F. R. Baldock & International Electric Co. February 14th.

2,693. "Magnetic compasses for aircraft, ships, &c." F. D. Donovan. February 15th.

2,745. "Electric distribution systems." British Thomson-Houston Co. and J. Whitcher. February 15th.

2,746. "Electron discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 15th.

2,757. "Fire-prevention device for electric cables." J. H. Collie and Simplex Conduits, Ltd. February 15th.

2,762. "Three-phase salt-bath electric hardening furnace." J. E. P. Kievits & Kynochs, Ltd. February 16th.

2,768. "Apparatus for demonstrating systems of electric wiring." D. Rowan. February 16th.

2,769. "Measurement or indication of alternating-current quantities." E. Fawssett. February 16th.

2,782. "Ignition devices." E. A. F. Naud. February 16th. (France, January 24th, 1917.)

2,790. "Mouthpiece for use with telephone transmitters." P. Whysall. February 16th.

2,796. "Electric relays." L. F. Blandy & L. B. Turner. February 16th.

2,800. "Electric clocks." P. P. Anderson. February 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

16,423. Sparking Plugs. R. Henry & E. Herrmann. December 2nd, 1915. (102,490.)

1917.

999. Dynamo-electric Machinery. Electromotors, Ltd., B. Longbottom and E. Greenhalgh. January 20th, 1917. (112,800.)

1,110. Induction Coils. N. Stell. January 23rd, 1917. (112,803.)

1,113. Method for Guiding the Electric Wire into the Groove of Trolley Wheels of Tramcars and such like Vehicles. T. Main. January 23rd, 1917. (112,804.)

1,315. Ovens and Hot Cupboards Heated by Electricity, Steam, Oil, or Gas. F. P. Fletcher. January 26th, 1917. (112,821.)

1,587. Polyphase Electric Transformers. British Electric Transformer Co. & F. E Berry January 31st, 1917. (112,829.)

2,623. Tanks for Oil-break Electric Switches. R. W. Gregory and A. Reyrolle & Co. February 22nd, 1917. (112,845.)

3,235. Electric Controllers and the like. G. Ellison & J. Anderson. March 5th, 1917. (Cognate application, 7,372/17.) (112,849.)

4,651. Means for Rendering Water Radio-active. G. E. Heyl & T. T. Baker. March 30th, 1917. (112,865.)

4,739. Protective Gear for Dynamo-electric Generators. H. Pearce. April 2nd, 1917. (112,867.)

7,141. Electric Flashlights. H. Bieber. May 18th, 1917. (112,887.)

7,591. Insulators. J. Sayer. May 26th, 1916. (107,006.)

8,271. Alternating-current Machinery. R. Pohl. June 9th, 1917. (112,890.)

8,690. Reflectors for Electric Bulb Lamps. H. S. Willis & H. A. Taylor. August 11th, 1916. (108,670.)

9,898. Electric Transmission of Signals. E. A. Laidlaw & W. H. Grinsted. July 9th, 1917. (Addition to 1,653/17.) (112,897.)

14,120. Insulators for Telephone, Telegraph, and other Wires. T. Taylor. October 1st, 1917 (112,911.)

14,373. Pocket Flashlamps. H. C. Cloake (C. S. Cloake). December 1st, 1916. (Divided application on 17,275/16.) (112,913.)

14,411. Electrical Transformers and the like. Siemens Schuckertwerke Ges. December 2nd, 1916. (111,837.)

Electric Pocket Lamps.—According to a U.S.A. Consular report, a new dry battery for electric pocket lamps has been invented by a citizen of Zurich. Instead of a single block battery, it consists of three distinct elements, which are placed side by side in the metal lamp case. In the event of the battery becoming defective, the voltage of each element is tested to ascertain which one is useless, and it may then be replaced by a single new element. Naturally the cost is considerably reduced. Another important improvement is the possibility of using the new battery in connection with almost any pocket-lamp case now in use. In spite of the exorbitant prices that one must pay now for raw material in Switzerland, the cost of manufacture of this battery is still figured 50 per cent. lower than that of the old battery.

Electricians' Licences in Johannesburg.—The Secretary of Public Works and the Master Builders' Association have now agreed upon a scheme for the licensing of electricians contained in by-laws submitted by the Johannesburg T.C.

The licences are to be obtained on examination by the Council, and proof must be given that the candidate has worked for not less than five years as an electrical artisan, including the apprenticeship period. The licensee must conform with the regulations in force within the municipality. A lengthy syllabus is proposed, and the examination is to be held by the authorities of the South African School of Mines and Technology, as in the case of plumbers. A Board of Examiners, representative of the parties concerned, will be formed.

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THE NEW PATENT BILL.

THE Patents and Designs Bill, which was introduced in the House of Commons by Sir Albert Stanley in November last, and which will shortly come under discussion, demands the close attention of all who are interested in the industrial progress of the country, as well as all present or prospective inventors, patentees, and manufacturers whose personal interests are affected by its provisions. It is designed to remove the defects of the Act of 1907, which have been revealed by the experience of its working, as well as those of the Temporary Rules put into force in 1914 to meet the conditions of war-time, and to introduce much-needed reforms into our patent system. While it is impossible in the space at our disposal to discuss its provisions in detail, there are certain points to which we wish to draw the attention of our readers.

We have pointed out on previous occasions that the prime object of granting a monopoly to the inventor of a new process or device is not to secure for him the opportunity of acquiring profits, but to induce him to publish his invention, and ultimately to place it at the disposal of the public, with a view to advancing the industrial prosperity of the nation as a whole. A secondary object, however, is to reward the inventor for his labour, and to encourage him to exercise his brain in further inventive effort, by affording him protection against the unscrupulous who would exploit his genius for their own advantage, and enabling him to obtain the support of capital; and a third aim is to attract new industries to this country with a view to their establishment amongst us—the last, in fact, being the original motive of the grant of letters patent for inventions under the Statute of Monopolies in 1623. Three centuries ago we led the world in this respect, although we had not then become a great industrial nation; it cannot, unfortunately, be said that we have retained our lead, and, while the new Bill goes some way towards regaining the lost ground, it appears to us to fall short of the desired end in several respects.

Hitherto the principal object of the Patent Acts seems to have been to provide a comfortable income for the lawyers, and that of the Patent Office to secure as large a net revenue as possible for the National Exchequer, neither of which aims can be commended as being in the best interests of the nation, while the true purpose of the institution has received but scant attention from Parliament. The legal procedure involved in the defence of patents against infringement has been costly and protracted in the extreme, rendering it impossible for any but the well-to-do to maintain a patent against the attacks of powerful rivals, and culminating in an appeal to a tribunal—the House of Lords—which merely reviews the recorded evidence, hears legal arguments, and not rarely pronounces judgments on this meagre basis which not only contradict the Courts below, but also appear to be contrary to justice and equity—sometimes by a bare majority in a small House. So long as the House of Lords remains the Supreme Court of the United Kingdom, no doubt this state of things cannot be remedied; but, at least, all possible efforts should be made to simplify and shorten the procedure, to enlarge the powers of the Comptroller, and to reduce the number and variety of the legal devices by which the process is encumbered and the ends of justice too often are defeated.

While the public welfare is the fundamental consideration, and the inventor's reward a secondary matter, it must not be forgotten that the encouragement of the inventor incidentally promotes the former aim; this fact has been admirably exemplified in the establishment, by the Government of special departments for the investigation of inventions for the purpose of prosecuting the war, and though hardly one proposal in 10,000 may prove fruitful, it is well worth while to wade through the 9,999 in order to secure that one idea. Precisely the same reasoning applies to peace conditions, but before the war it never entered the heads of our rulers that they should appeal to the inventor to come forward with new ideas. On the contrary, many obstacles were thrust in his path; he was called upon not only to pay a fee on application for letters patent, but also to pay heavy fees for their maintenance, under penalty of total loss of the patent, and, in addition, to pay taxes on his income. We agree that an application fee is necessary to prevent the flooding of the Patent Office with worthless ideas, but on what grounds can the exaction of the heavy renewal fees, amounting in the course of the life of the patent to £95, be justified? In this respect we much prefer the procedure of the United States, which grants a patent (and carries out an extensive search into priority) for a single payment of £7. In order, however, to secure the extinction of patents which are worthless in themselves, but nevertheless hinder progress, we suggest that a payment of, say, a further £5 at the end of the fifth and the tenth year respectively might very well be imposed. Again, the life of a British patent is restricted to 14 years; the new Bill proposes to extend this period to 15 or 16 years, but we submit that a still longer period is called for by modern conditions.

The majority of useful inventions nowadays take several years to perfect and to introduce into general use, and the 10 years or so which represent the *useful* life of the patent are much too short to provide an adequate reward to the inventor or manufacturer. In the United States the period is 17 years, and in Canada it is 18; we suggest that the latter figure should be adopted, not only in this country, but throughout the Empire, and that, while there are valid objections to establishing a single Empire patent, the regulations, procedure, and fees should be made identical for each of its components, the whole of the Crown Colonies, however, being covered by a single British patent.

In order to prevent the use of patents by aliens to establish monopolies for their imported manufactures, the Act of 1907 provided for the revocation of a patent if it were not adequately worked in this country; the method of attaining this object, however, proved defective—obviously, the revocation of a patent removes all incentive to a British manufacturer to make use of the device—and the new Bill provides other and more effective means of attaining the desired end, which we hope will be found satisfactory.

Overseas Trade of the Future.

The speech of Sir Arthur Steel-Maitland on the Vote for Salaries, &c., of the Overseas Trade Department did not contain much information that would be new to our readers, as we have already been permitted to describe the plan of operation of the Department in these pages. But only good can result from such a statement to members of the House of Commons and to the nation as a whole. The same remark applies to the discussion which followed the speech, in which different members referred to the well-worn subject of the past deficiencies of our Consular Service. Sir Arthur does not seem to agree altogether with the usual criticisms, and he repeats his statement that we and competing industrial peoples all seem to think that the other has the best service. He considers that the duties that a Consul can perform to the commercial community are sometimes over-estimated. "Sometimes" they may be, but the solid fact remains that there has been practical unanimity in the business world on the question for many years. We have welcomed the new scheme under which Trade Commissioners and Commercial Attachés will be "watching out" zealously in many parts of the world under the new scheme, but in the many places which cannot be favoured with such officials there should be great opportunities for Consuls to show more regard for British trade interests than has been the practice in the past. Sir Arthur does not lose sight of this circumstance. He considers that a consul should possess a really good working knowledge of the trade of the place in which he is stationed, and of the principal traders, so that British business-seekers may be able to obtain from him a general idea of the commercial "lie of the land." When the new system comes into force the more promising Consuls will be eligible as Commercial Attachés after passing work of the Commercial Attachés to collect information from consular districts, to give a good economical survey of the country as a whole, and to inspect the work of the Consuls, seeing that they are doing their duty. This is the proposal in its broadest outline, but the whole of the consular scheme is under consideration with a view to making it adequate to meet after-the-war requirements.

The success of the efforts of the Overseas Trade Department, as has been pointed out before, depends upon the spirit of good-will and co-operation which may exist between the Board of Trade and the Foreign Office, but it is also dependent upon the measure of confidence with which the scheme is regarded by the business community. If our traders make a frequent and persistent practice of using the service in their efforts to develop commerce, they will do much to assist both Commercial Attachés and Consuls to attain to and maintain a high standard of efficiency. That practice will go far to impress them with the importance of the assistance which they can render to British industries, and they will feel compelled to live up to their position. Want of confidence and want of appreciation have made travellers contemptuously ignore British facilities too often in the past, seeking assistance instead, and at greater pains, in unthinkable offices in the same districts.

It is satisfactory to know that all of the Department's representatives will in future be on the watch for enemy efforts at penetration, yet we cannot forget that some of them have not been unmindful of this tendency in days gone by. Many a consular report and other public document abstracted in our pages in pre-war days told a good deal about what was going on, but of what use was it to know that these things were happening if there was nobody to take appropriate measures to counteract them? We trust that the awakened interest of the legislature in trade affairs, and the existence of trade associations, will provide means for remedying this shortcoming in the future. We were too content in those days, as Sir Arthur recognises, to allow the questions relating to the development of our foreign trade and that of our commercial rivals to go unanalysed, and competition to go without being properly met. The new department, through its various officers, will see to it that movements are watched for and reported upon; but there presumably the work of the department will end, and industry or some other department of the State will have to act.

LEAVES FROM AN ENGINEER'S LOG.

I.—The Volunteer Munition Workers.

By "WHISTLEFIELD."

Our troubles began when the Ministry of Munitions appealed for volunteer munition workers. The fitters, drivers, and other skilled and semi-skilled men about the works thought this was a first-class opportunity to put the screw on the Chief for an increase of pay, and use their new-found patriotism as the lever; but the Chief wasn't born yesterday. He listened patiently and sympathetically to the deputation, drew them on when they worked the patriotic vein, and got each man tied down to the statement that he could do a lot more than he was doing each week, and that he would like to put in the extra time on munitions to help the country. They had expected the Chief to point out that they couldn't be spared from the station, and then they meant to put in strongly for an all-round increase. The Chief warmly commended them for their patriotism, and said he would see what could be done to put them all on munitions. This was hardly what they had expected, and the deputation retired rather crestfallen, but it was nothing to their chagrin when he announced a few days later that he had taken on a contract for the manufacture of 18-pounder high explosive shell, and would install sufficient machines in our workshops to enable each man to put in three evenings a week on shell, in addition to any time he could be spared during ordinary working hours.

He stated, further, that he would modify the usual conditions upon which they were appointed, namely, that their wages were to cover all the ordinary overtime required, and would pay them for all extra time spent on shell at a nominal rate, till they had gained sufficient experience to make the job pay.

There was a good deal of heart-burning among the skilled men who had formed the deputation, especially at the "nominal rate," but they had to admit that the Chief had scored again, and they were too far committed by their own words to draw back.

Sandy McNab, the mechanical superintendent, however, was a happy man from that day. The Chief had begged, borrowed, or rented, all the old lathes he could lay hands on, chiefly from other Corporation Departments, and from consumers who could find no further use for them, but Sandy took the lot without question, and vowed he would make them into proper working lathes again. He saw some prospect at last of realising his life's dream of running a fully equipped workshop. Sandy toiled like a Trojan himself, and he saw to it that his assistants did not slack; though they were all volunteer workers on that job, still they dare not fall out with Sandy, who looked after them like a father, but ruled with a rod of iron, and had an unpleasantly long memory, and a skilful tongue, which could make them writhe.

They were all more or less related to him, or to his wife, he knew all their family histories, and could use that knowledge with biting effect, when any of them showed signs of revolt; besides, Sandy could always manipulate both the paid and the unpaid overtime, and everyone of them had quickly realised that it did not pay to cross the "old man."

In the early days of the war, the Second proposed to Sandy that he should sound the men to see if they would have regular contributions deducted from their pay for the Prince of Wales's fund, and Sandy promptly replied: "You tell me how much you want to raise a week, Sir, and I'll blurry well see that they pay it." The Second made it quite clear that anything that was done must be purely voluntary, and Sandy said that he'd see to *that* all right. Perhaps it was a coincidence that our voluntary contributions put all the other Corporation Departments' efforts in the shade.

In the Second's special file, always locked up, was a genealogical chart showing Sandy's relationship to all his men. It had been slowly constructed after many quiet smokes by the fire in Sandy's office, during the periods of evening peak load, and had cost the Second a good many ounces of a tobacco to which Sandy was very partial, but that chart saved the department a great deal of paid overtime; for example, when the office hot-water radiator system needed overhauling during the Christmas holidays, the Second told Sandy that on no account must the blacksmith be brought in as a stand-by on that job. Now, the blacksmith was Sandy's first cousin, and since he was barred from making overtime, Sandy took care that the carpenter, who was only distantly related to his wife, was not allowed to hang about the job the whole time, but had to open up the floors along the pipe run, and come back after the plumber, who was the wife's brother-in-law, had finished his job.

Sandy could never understand why the Second took sudden dislikes to first one and then another of his men, but he did not know anything about that genealogical tree or connect it with the Second's fondness for family histories, a subject on which Sandy rather prided himself.

The genealogical tree proved very useful during the preliminary work of converting the workshop into a munition factory, and many of Sandy's pet ideas were nipped in the bud, such as making nests of pigeon holes for holding finished shell; that was because the blacksmith was putting in a good deal of overtime at nominal rates, and Sandy wanted to make sure the wife's relatives didn't get off too easily.

When the preliminaries were over, and we settled down to the real business of machining shell bar, the family adjustments threatened to plunge the job into financial disaster, so the Chief intervened, and said the Second would arrange who was to do each operation, and a man once allocated to an operation must not be put on to another without special permission. This quickly improved the output, and reduced the percentage of scrap, because each man had a chance to get expert on his operation, and make quick time; in fact, some of the boys did so well, that the Chief decided to fill up with boys and work the machines the round of the clock. The skilled men on the staff gradually dropped out of the job, on one pretext or another, and as it enabled the munitions to be run in two full shifts, they were allowed to go, and were only brought in to repair any breakdowns in the machines.

ELECTRICAL SHOE MAKING.

By G. BASIL BARHAM.

The installation at the first shoe factory in the world to be equipped electrically throughout has recently been completed, and it is remarkable for the fact that steam and gas have been entirely eliminated for machine heating and power purposes.

In boot and shoe factories steam has hitherto been considered indispensable. Certain operations, as Goodyear welt stitching, Goodyear welting, bottom dryers, box toe steamers, and the steaming of box toes for pulling-over machines, have required, and do require, steam to-day in every factory in the world except the one under notice. But in this factory there is not an ounce of steam used for any purpose except that of auxiliary heating in the depths of winter.

This in itself has saved considerable expense, as even factory plants that employ electric power for driving have hitherto had to keep boilers running in order to furnish steam for the machines mentioned. But under the new conditions there is no need to install steam plant at all, as adequate and cheap systems of electric or gas heating could easily be put in for winter use.

In installing electricity in place of steam in the new factory, one of the greatest difficulties was in connection with the Goodyear stichers. It is, of course, necessary that the thread must be heated and kept "ripe" at all times, and it is also necessary that the wax through which it runs should be kept in a fluid state. This has been done in the new machine, and, according to the operatives, it is carried out to the highest degree of efficiency. There is no risk of the wax pots boiling over, as under the steam process, as the heat can be maintained by the operator at the right temperature without the least trouble. There is no necessity for keeping the windows closed to prevent the machines from cooling, and the operatives can, consequently, work in greater comfort. The same is true of the Goodyear welting machines, in which it is necessary to keep the thread tempered in a similar manner.

Difficulty was also experienced in connection with the box-toe steamers, steam being necessary to soften the box-toes so as to allow them to be properly worked. This is done in the new electrically-operated factory by a box arrangement in which the toe of the shoe is inserted, and the necessary steam is produced locally by an electric heating element. There is a somewhat similar machine for steaming the box-toes before they go to the pulling-over machines. Then there are the stamping machines, which are heated by electricity instead of steam, as in the past, and, according to an account just received by the writer, the bottom drying apparatus is so designed that it can be made as large as would be necessary to meet the requirements of any factory. Instead of the coils of steam piping that were necessary before the new dryers were put in, there are a number of electric heating elements somewhat similar to those used in connection with the larger electric flat-irons, and these provide a dry heat which is said to do the work much more quickly than that available from steam-heated appliances. Then there is the Gem innersole machine, where it is necessary for an even temperature to be maintained. This is quite a simple matter with the electric heating elements, as it is practically impossible for the temperature to vary.

Another ingenious machine is that used for the bottom filler to replace the former steam contrivance. This requires that the roll be kept warm, the knives at the right temperature, and the filler mixture at the right heat for doing the work; and the report of all who have worked the machine, or seen it in operation, is that it is a great improvement on the machines and methods previously in use.

From a financial point of view the innovation has amply justified itself, as not only is the cost of electrical energy a small matter, but there is the great saving to be taken into account resulting from its being unnecessary to keep up fires in the stokehole to maintain an adequate steam pressure for possibly only a few machines.

ELECTRICAL DEVELOPMENTS IN ITALY.

By E. STRACHAN MORGAN.

The invention of the water-turbine in 1850 was a pre-requisite to the use of water-power for the development of electrical energy. Its substitution for the cumbrous overshot or undershot wheels first made it possible to utilise water-power on anything like a large scale, and the Italians were not slow to appreciate the advantages of this new motor.

By the year 1891 250,000 H.P. were already utilised in this way, but the application of it to industry laboured under one serious disadvantage. The factory had to be taken to where the waterfall was, and the conveyance of the head of water by means of flumes from the narrow valley, where large water-power is for the most part located, to areas better suited for the erection of industrial buildings and more accessible for the supply of raw material, was necessarily restricted in distance. It was not till 1889 that the next great step was taken. In that year the continuous-current electrical installation at Isoverde, above Genoa, the first large one in the world, proved to be the first waving of the magician's wand. In 1890 another important step was taken by the harnessing of the falls of Tivoli, and the conveyance of the energy by alternating current to Rome. At that time it was held to be a marvel to convey the current a distance of 27 kilometres with a pressure of 5,000 volts only, and a leakage of 25 per cent. on the way.

Such a result would now be considered quite contemptible, yet it was a notable landmark, and that enterprise fills the first page of the volume in which will, in all probability, be written the story of the change of Italy from an agricultural country, dotted with some few industries precariously kept in being by a stringent protectionist *régime*, to a great manufacturing State able to hold its own against the countries to which abundance of coal and iron had given what seemed to be an indisputable primacy. As the use of coal and steam extinguished the furnaces of Sussex, so this new force may prove that the waterfall can compete on at least equal terms with the coal mine.

To one looking back on what has been done in the past 20 years, there is unfolded a story of progress sufficiently startling to those who still look on Italy as a mere museum of classical remains and mediæval art, whose inhabitants are making somewhat futile endeavours towards industrial attainment. The men of the next generation will see in a comparison between their installations and those of the past decade a development as surprising as that which separates the old "Puffing Billy" of the Darlington Museum from the engine that whirls the "Riviera" express from Paddington to Penzance. There have been inevitable mistakes on the part of technical men, some inherent in the tentative use of a new instrument, many due to a want of faith in the prodigious powers of that new instrument and the unlimited scope of its possibilities. Their plans were laid on too small a scale; energies were misdirected; companies were often over-capitalised; there was needless and harmful clashing of interests. There is good reason to hope that these lessons have been taken to heart, and that future developments will be carried out on a more systematic plan, embracing all the latent forces of the country. As yet the story of the stupendous work that has been carried out during the war may not be told, but when the veil of secrecy is lifted, it will be realised that the marvels of the *teleferiche* on the fighting front have been at least equalled by the manufacturing developments behind.

It must be admitted that in the past the Government has not played a part worthy of it. Red-tape regulations and narrow-minded fiscality have hampered the efforts made to give a free life to the new industry. Two instances may be given of this step-motherly treatment:—(1) In Norway energy is sold at £20 per H.P. per annum. In Italy taxation alone takes more than this. (2) There were a short time ago lying in the Ministero delle Finanze 2,600 demands for water-power concessions, some of which had been on file for more than 20 years. Even by the provisions of the Villa Bill, drafted with a view to simplifying procedure, every demand goes through 12 stages; it goes to the Prefetto, to the Genio Civile, to the Magistrato Supremo delle Acque in Rome, then back to the Prefetto, to the Deputazione Provinciale, then back to the Genio Civile, which at last orders a survey of the local conditions, then back to the Magistrato Supremo in Rome, then to the Ministero dei Lavori Pubblici, then back to the Magistrato Supremo, then to the Ministero delle Finanze, at whose recommendation the concession may be granted by a Decreto Reale. It does not take much knowledge of bureaucratic procedure to realise what considerable possibilities of delay there are even in this "express" treatment of a demand.

In spite of these disadvantages, the progress made in the development of hydro-electricity has been very great. Before giving an account of the work accomplished on the technical side, it will be well to refer to the financial framework on which that development was based, and for understanding this it is necessary to take into account the operations of the Banca Commerciale Italiana, on which all these activities are hinged. And it must be in fairness admitted that a great part of that success is due to Germany. Acting through Italian industrial banks, German capitalists and German industrial firms canalised the brilliant genius of Italian electricians into industrial channels, and showed them how the science of Galvani and Volta might best be used for the furtherance of national well-being. It is especially owing to this influence that the development of electrical energy has made such great strides during the past 20 years. Not that German capital was largely employed. On the contrary, while English, French, and Belgian capital invested in Italy up to 1913 amounted to about £440,000,000, no more than £44,000,000 was contributed by the Central Empires, but the Italian public, relying on the great ability with which the Banca Commerciale was managed, placed very large deposits under its control, besides contributing important sums to the increase of its capital by taking up new shares as issued. The function of the Bank was, therefore, to provide organisation for the development of the electrical industry and Italian capital for making that development possible. Though the German managers and experts who took part in this development never lost sight of the promotion of German interests, the benefit that they conferred on Italy cannot be called in question. In an article published by Dr. Uebelhor in the *Weltwirtschaft* (January 16th, 1916) on this subject, after a review of the work done by the B.C.I., he wrote:—"How can Italy either in the present or the future develop without German aid? All our information points to the fact that Italy is quite unable to provide a substitute for the support it has lost. Accordingly, we are quite certain that this support will be called in again, and here we may find an answer to the riddle why the Italian Government has not as yet declared war on Germany." The stupendous work which Italian electrical engineers have done in the establishment of munition factories during the past two years provides a very practical rejoinder to the Doctor's query.

How Germany benefited by this arrangement may be seen, in part at least, in the Custom House returns which are quoted farther on. And some hints may there be found as to how English finance and English manufacturers may meet with the heartiest welcome in Italy, and help to further our common object: the development of Italian industries. Be that as it may, the development of electrical enterprise in Italy during the 20 years that followed the bringing in of electrical energy from Tivoli to Rome in 1892 is a story of absorbing interest.

A great impulse was given to this growth by the success of the Brown experiment, 1891-1892, which demonstrated that, by the use of the polyphase system, electrical energy could be successfully distributed to considerable distances. In this particular case the distance was about 100 miles, and the pressure 30,000 volts. Since then the pressure has been increased to over 100,000 volts, and the distance to which energy can be conveyed is only limited by economical considerations.

(To be continued.)

PROCESSES FOR THE MANUFACTURE OF ALUMINIUM.

Most of the aluminium works at present in commercial operation use the Héroult process, very little modified since its introduction in 1876. The raw materials employed, the equipment used, the precautions observed, and the results obtained were described recently by H. Jean Escard.* Alumina (Al_2O_3) in a bath of molten cryolite is subjected to electrolysis, and yields metallic aluminium and free oxygen which burns the carbon electrode to form carbon-monoxide; the latter, in turn, yields carbon-dioxide. The same supply of electrical energy which is used to effect electrolysis is also used to keep molten the salts concerned, but since heavy expenditure of energy is necessary for the double purpose, the process can only be worked commercially where very cheap energy is available. Electrolysis may be effected in a furnace lined more or less completely with carbon connected to the negative pole of the electricity supply. Adjustable vertical electrodes are connected to the positive pole, and aluminium liberated by electrolysis collects at the bottom of the furnace.

It is necessary to maintain close supervision over the composition of the bath. If the alumina content becomes too low, fluoric gases are liberated at the anode, and sodium is deposited at the cathode, where it has injurious influence on the quality of aluminium. Frequent additions of alumina and, when required, of cryolite prevent the occurrence of secondary actions. Experience shows that certain fluxes are essential to success Calcium fluoride, aluminium fluoride, sodium chloride, and other salts are used in this connection, and in the nature and proportion of the fluxes lies one of the principal differences between the methods employed by various concerns engaged in the manufacture of aluminium.

The two principal phases of the complete manufacturing process are the treatment of the mineral to obtain alumina (which must be in the highest attainable state of purity), and the extraction of aluminium from the prepared raw materials. Bauxite is the mineral universally employed, and if cheap energy be available there, it is obviously desirable to locate the manufacturing works as near as possible to the bauxite deposits.

Treatment of the Mineral.—Bauxite is an impure hydrate of alumina containing from 60 to 80 per cent. of alumina, 2 to 10 per cent. of silica, 10 to 25 per cent. of iron sesquioxide, 10 to 15 per cent. of water, and 1 to 2 per cent. of titanic acid. White bauxites contain silica as the predominant impurity, and are difficult to purify. Red bauxites contain a high percentage of iron sesquioxide (generally 16 to 17 per cent., and sometimes 25 per cent.), and are the form of mineral generally employed. The alumina content should not be lower than 57 per cent., nor the silica content higher than 3 per cent. Rich and poor minerals are mixed to yield the desired average composition.

The purification of bauxite to yield alumina is a delicate and important operation influenced considerably by the peculiar chemical properties of alumina, which is an oxide combining with acids to form aluminium salts, or with strong bases to yield aluminates. Whether hydrated or anhydrous, alumina is insoluble in water. It melts at the temperature of the electric furnace, and is then transformed into a sort of artificial corundum, very hard, and almost unaffected by all ordinary bases and acids.

There are various wet and dry processes for the treatment of bauxite. The Deville process, in which the mineral is first attacked at red-heat by sodium carbonate, is seldom employed at the present day. In the Peniakoff process, which is used by several works, sodium aluminate is prepared from bauxite and sodium chloride. A mixture of bauxite and sodium sulphate is reduced by carbon, or by iron sulphate by heating to 1,200 deg. C. in a rotary furnace. The sulphurous anhydride which is liberated is mixed with air and steam, and directed on to sodium chloride. The products of this action are sodium sulphate, which is used with more bauxite; and hydrochloric acid, which is sold. The furnace product is washed with water to extract sodium aluminate, and alumina is precipitated from the filtered solution, as in the Deville process.

The Bayer wet process is the one most employed. Bauxite is broken up, heated to 700 deg. C., and subjected to the action of soda solution (density 1.4 to 1.45) in a steam-heated digester with agitation. The solution of sodium aluminate thus formed is diluted to 1.25 density and filtered. Under the action of free alumina, and in the presence of an excess of water, the aluminate is hydrolysed, and alumina is precipitated. The Vergé process eliminates the preliminary roasting by using high-pressure steam in the digester.

By whatever means it is obtained, alumina must be calcined (at about 900 deg. C.) in order to make it quite anhydrous. Considerable expenditure of fuel and loss of alumina are involved, so that the final yield is about one ton of alumina from two tons of bauxite. The use of clays (containing 40 to 45 per cent. of alumina) seems to offer promising possibilities of reducing the cost of preparing pure alumina. Nitration processes also offer great possibilities. If bauxite be heated in an electric furnace to 1,800-1,900 deg. C. in the presence of nitrogen, one obtains aluminium nitrate, which may then be digested with soda solution to yield ammonia (from which ammonium sulphate may be prepared for manurial purposes) and sodium aluminate, from which alumina may be precipitated. It is understood that several works are about to use this process, if they have not already commenced doing so.

Cryolite and Fluxes.—Cryolite is double fluoride of aluminium and sodium, and its function is to dissolve alumina for electrolysis. The only known natural deposit of cryolite of any importance is at Ivigtut (Greenland). Most of the cryolite now used in aluminium works is prepared by one or other of several synthetic processes, all of which are based on the use of a fluoride. The Hulin process, used in France by the Société d'Electrochimie, consists in neutralising pure hydrated alumina by hydrofluoric acid. This yields fluoaluminic acid, which is saturated by sodium dioxide to yield insoluble cryolite and pure oxygenated water, which is a valuable by-product.

Natural or artificial cryolite melts at about 1000 deg. C., but by adding up to 5 per cent. of alumina the melting point decreases to a minimum at 915 deg. C. Thereafter the melting point rises again to 1,015 deg. C. with 20 per cent. of alumina. There may be a second minimum (950 deg. C.) with 10 per cent. of alumina. In practice, one should keep the melting point between 900 and 950 deg. C., corresponding to from 4 to 6 per cent. of alumina, with a sharply defined minimum for a mixture with 5 per cent alumina. The melting point may be lowered yet further by the addition of fluxes. For instance, works using the Hall process employ a mixture of cryolite 36 per cent., calcium fluoride 20 per cent., and aluminium fluoride 44 per cent., thus obtaining a bath which melts at 800 deg. C., and dissolves alumina more effectively than cryolite alone. Alkaline chlorides permit the melting point to be lowered to 700 deg. C., but these salts evaporate rapidly, and thus render unstable the composition of the bath. French works employing the Hall process generally use a lower percentage of aluminium fluoride than specified above.

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* *Revue Generale d'Electricité*, October 13th, 1917, pp. 577-585.

Electrodes.—On the purity of the electrodes, to an even greater extent than on the purity of the alumina and cryolite, depends the quality of the aluminium obtained. The carbon used must be as pure as possible, with little ash and a minimum of iron and silicon. The raw material used may be oil coke, tar, or anthracite. Oil coke is generally preferred. This yields only ½ to 2 per cent. of ash, but often contains 1½ per cent. of sulphur. Volatile constituents amount to 12 or 15 per cent., and are expelled as completely as possible by preliminary heating in vertical retorts. Gas coke is not a good raw material owing to its high silica content.

In making electrodes, crushed coke is mixed with hot tar to form a paste, which is then formed into rods by a powerful horizontal press, cut into lengths, and baked at red heat. An electrode thus made may contain 97.2 per cent. fixed carbon, 1.4 per cent. ash, 0.65 per cent. volatile matter, 0.4 per cent. sulphur, and 0.35 per cent. moisture.

The dimensions of electrodes vary considerably. Sometimes their section is square (say 10 in. × 10 in.), sometimes a rectangular section is preferred (say 4 in. × 3 in.) in order to save weight. There is serious wastage of anodes by burning, and in order to reduce this loss, which amounts sometimes to 1½ or 2¼ lb. per lb. of aluminium produced, some works use anodes in the form of a cube or of a truncated pyramid, with the small end plunged in the bath. The electrode is then almost submerged, and consumption is greatly reduced; if the length be 12 to 20 in. and the side dimension of the section 10 or 12 in., the electrode will weigh 75 to 155 lb.

Excellent connection is needed between electrodes and supply conductors if losses are to be avoided. At the same time, metallic pieces used to make these connections must be protected from the heat of the bath. An axial connection is preferable from this point of view, and it may be made either by screwing a lug into a threaded hole at the end of the electrode (see fig. 1) or by "casting-in" the terminal strip or rod with molten bronze. Either of these arrangements permits the carbon to be used almost completely, which is an important consideration, because the electrodes cost £14 or £15 per ton. If "stumps" of any considerable size are obtained more than occasionally, they should if possible be trimmed up, and then screwed or bolted together in the form of a new electrode. Stumps which cannot be used economically in this manner may be broken, ground, and used in the manufacture of new electrodes.

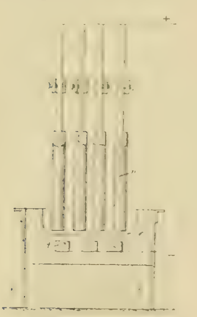

FIG. 1.—ALUMINIUM FURNACE WITH PISÉ BED.

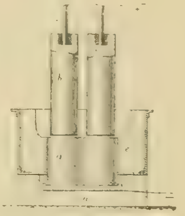

FIG. 2.—FURNACE WITH SOLE ELECTRODE.

Furnaces.—There are several types of furnace used in the manufacture of aluminium. One type, illustrated in fig. 1, has a bed *e* of carbon pisé resting on a block of refractory masonry *s*. The latter may be extended up the sides of the furnace, next to the sheet steel casing *p*, in order to reduce the amount of carbon pisé required. The furnace is rectangular in form, with a tapping hole in one long side, and a number of iron plates *f* buried in the pisé to connect the latter to the negative main. The vertical electrodes may be adjusted separately or simultaneously, either mechanically or by hand. A strong framework is needed to carry the heavy electrodes.

The principal disadvantages of this type of furnace are: (1) That since the pisé cannot well be baked except *in situ*, there are volumes of tar vapour evolved each time a fresh lining is put into commission. (2) The pisé never acquires electrical conductivity comparable with that of electrodes extruded under pressure and baked at high temperature.

For these reasons many works employ the type of furnace shown in fig. 2. A thick iron plate *m*, connected to the negative supply main, carries eight or 10 prismatic electrodes *a* (each about 12 in. diameter or side), which terminate flush with the bottom of the furnace trough made by ramming carbon pisé round the sole electrodes as shown. The emission of tar vapour is much reduced, and the electrical resistance of the furnace bottom is almost negligible. There is generally an anode *b*, of slightly smaller section, corresponding to each sole electrode, but the exact arrangement of anodes depends on their size. If the anode section is small (3 or 4 in. side) there may be four rows with 8 or 9 electrodes in each, making a total surface of 2.75 to 3.1 sq. ft. With larger carbons (10 in. side) there may be two rows of five electrodes corresponding to 6.75 sq. ft. surface.

(To be concluded.)

METHODS OF DIRECTING AND CONCENTRATING LIGHT.

By LIEUT.-COMDR. HAYDN T. HARRISON, R.N.V.R.

(Abstract of paper read before the ILLUMINATING ENGINEERING SOCIETY.)

DURING some researches and experiments on the suitability of various light sources for projection purposes, and on the efficiency of various reflectors, lenses, prismatic devices, &c., intended for use with such light sources, I have encountered certain details which may interest those whose business it is to devise and manufacture means for utilising light energy to the best advantage.

Most of my work has been in connection with regular or specular reflectors, such as polished metal or silvered glass surfaces. Such reflectors follow very definite laws, and can be designed and produced on very accurate lines. It was, therefore, not surprising that the light sources with which they were intended to be used claimed more attention than the reflectors themselves.

Some idea of the luminous value obtained by the concentration of light can be gathered from the following table, which has been calculated by dividing the solid angle of the beam produced into the solid angle of luminous flux, which is utilised. Three examples of the latter are given, namely, 270 degrees, 180 degrees, and 90 degrees, being the equivalent of deep, medium, and shallow reflectors. The last type is that generally used in conjunction with the arc for searchlight purposes.

Total Angle of Dispersion. Degrees.	Multiplying Power of Beam. 270 deg.	180 deg.	90 deg.
1	42,675	25,000	7,325
2	11,380	6,600	1,950
3	4,918	2,940	862
4	3,798	1,640	482
5	1,792	1,050	308
10	445	262	77
20	—	65	19
45	—	13	3.86
60	—	7.2	2.1
90	—	3.4	1.0

It is quite usual with shallow parabolic reflectors for the luminous power of the beam to reach 800 times the mean power received from the lamp, showing that the usual dispersion is between three and four degrees. With the more modern lamps the luminous power is increased 1,000 to 2,000 times that of the lamp, owing to its being possible to focus the small light source to less than three degrees.

With metal reflectors of the 270-degree class, a multiplication of 2,000 can be obtained when using small incandescent lamp filaments, but such a small dispersion as five degrees is rarely required for other than signalling work.

Dispersion takes place due to the area of the light source, and as dispersion in any degree must naturally increase the diameter in proportion to the distance, it follows that it increases the area illuminated in proportion to the square of the distance.

From this the two well-known laws are derived: (1) That beams closely approaching parallel can still be considered as following the square law, provided the illumination derived from them is measured at sufficient distance to eliminate any error due to the area of the secondary source or mirror; (2) that the luminous flux from a parabolic mirror focused to small dispersion is proportionate to the square of its area divided by the square of the area of the source.

In an important work by Jean Rey, the whole of the results produced by carbon arc searchlights are based on the relative area of the crater and the mirror, which tends to show that the author was of opinion that the boiling point of carbon represented the highest intrinsic brilliancy likely to be obtained.

It has been my duty during the last few years to develop into practical form a lamp, of which the intrinsic brilliancy per unit area of light bears the relation of 250,000 to 300,000 c.p. per sq. in. compared with 80,000 to 90,000 c.p. with the ordinary arc. Thus it would be unwise to consider the limit of intrinsic brilliancy as having been reached, as it is obvious that future high-efficiency lamps will not depend so much on increase of temperature of the light source as upon modifications in the light wave characteristic.

Apropos of this, it is interesting to note that the progress of gas illumination is largely due to the composition of the gas mantles, which, owing to the proportioning of the constituents, have been improved nearly 50 per cent.

It is probable that increased efficiency in electric lamps will result through increased intrinsic brilliancy; and, as the intrinsic brilliancy of electric lamps is already greater than can be permitted as naked light sources, globes or reflectors will be necessary in the future, and unless much of the efficiency gained is to be lost in such globes or reflectors, it will be necessary to study carefully the laws of reflection and dispersion.

One serious disadvantage of reflectors of the specular type when used in conjunction with filament lamps is that they project a very clear image of the filament, from which it follows that the degree of illumination produced by the beam varies considerably over various parts of the illuminated area. This fault is corrected to a certain extent by using a deep parabolic reflector which, owing to the greater solid angle subtended to the luminous source, not only has a higher efficiency, but also, on account of the greater number of angles from which the luminous flux is projected, superimposes in the illuminated area more varied views or reproductions of the source, thus tending to make the resultant illumination more even.

It is surprising that this type of reflector has not been more used for flood lighting, but probably the reason is that, with gas-filled lamps connected to the usual supply mains, the size of the bulbs would result in the reflectors having to be of deep focus, and therefore of considerable area. Nevertheless, it would appear that efficiency has been sacrificed to a serious extent, and this is witnessed by the figures published by L. C. Porter, Illuminating Engineering Society, U.S.A., June, 1917, which showed that with a 6-volt, 100-watt lamp more than double the beam power is produced than with a 32-volt lamp of the same candle-power when used in a 16-in. reflector of 3-in. focus.

Therefore, unless low-voltage lamps with concentrated filaments can be used, it would appear that flood lighting must continue to rely upon reflectors which receive less than half the total luminous flux.

In the case of headlights, there should be no difficulty in obtaining low voltage for use with special concentrated sources. I have obtained 16-volt gas-filled lamps, averaging 100 c.p., which, with an 8-in. diameter deep reflector, gave as much as 140,000 c.p. as measured by the illumination derived from the beam, and a mean of 76,000 c.p. over six degrees dispersion.

As regards the use of lenses or prismatic combinations in place of, or in conjunction with, reflectors, a long series of tests on those at present available has satisfied me that for projection work short-focus lenses and prisms have two disadvantages: (*a*) light absorption, due to thickness of glass; (*b*) cost, when a lens is combined with annular prisms, as in the Fresnel combination.

To make these successful the lenses and prisms must be small in order to reduce their thickness. Prismatic globes and shades appear to have a considerable future before them, provided the prisms are certainly not larger than those commonly found in Holophane glassware.

The "Pointolite" lamp, as manufactured by Edison and Swan, with a perfect spherical light source of small area, has proved of great value to me when testing reflectors of all descriptions. All irregularity in the illuminating power of the resultant beam disappears, with the exception that the luminous flux in the centre is reduced, due to the two thicknesses of glass through which the beam has to pass. If it were not for the fact that this is an arc lamp, and therefore only capable of absorbing 50 to 60 volts, whereas the supply pressure available is generally nearer 200 volts, this lamp would certainly be the most efficient small-light unit for use with concentrating reflectors or similar devices.

With irregularly shaped light sources the use of translucent globes or screens having internal reflecting surfaces is not so satisfactory as with small sources. It is, therefore, probable that gas-filled incandescent lamps, with their highly concentrated filaments, will make possible the use of many directive and diffusing devices which have proved very unsuitable when used in conjunction with vacuum lamps, owing to the large area over which the light source of the latter is spread. For example, a specular reflector shaped on parabolic lines can be made to concentrate two-thirds of the luminous flux from a half-watt lamp on to a 12- or 14-in. disk of ground or other suitable glass. This surface becomes diffusive, and is therefore suitable for illuminating most interiors from the ceiling. The intrinsic brilliancy of the surface can be regulated by a suitable choice of area. Therefore, without an undue loss of efficiency, the very brilliant gas-filled lamps of to-day can, by this simple contrivance be converted into a pleasing and efficient illuminating device for interior lighting.

The use of diffusive reflectors to attain the same object, unless of the indirect class, postulates that the light source is visible in certain positions. In order to overcome this, it is usual to make the reflector as deep as possible, thus reducing the angle over which the original light source is visible. By such means it is possible to increase the light flux at angles 30 to 45 degrees below the horizontal to double, or even two and a half times, the mean spherical candle-power of the source. Such reflectors have been very generally adopted, and give excellent results when judiciously spaced.

The use of ceilings as secondary light sources, as in the case of indirect lighting, will probably be largely developed after the war, as the great disadvantage of this system, namely, lack of efficiency, is largely wiped out by the great increase in the efficiency of the original light sources.

A disadvantage of indirect lighting as carried out in many instances is excessive diffusion of the light, thus producing a flat appearance, due to lack of contrast caused by the absence of shadows.

This disadvantage can be overcome by concentrating the light source on to a smaller area of the ceiling, which small area can be specially prepared, or covered with a suitable device, to increase its reflecting efficiency and permit of its being cleaned when necessary in order to maintain such efficiency.

In the indirect lighting fittings supplied by the General Electric Co. of America, which have been designed on very sound lines, the lower hemispherical rays are concentrated by means of silvered reflectors, thus reducing the area of the secondary source.

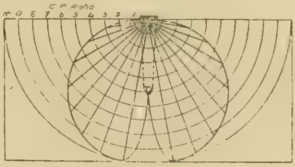

Fig. 1.

I would suggest the use of an inverted reflector which would receive the luminous flux from, say, 270 degrees solid angle, and concentrate it into a beam having, say, 5 degrees divergence. This, directed on to a suitable diffusive reflecting surface on the ceiling, would produce a secondary light source similar to the crater of the arc, but of greater area and lower intrinsic brilliancy.

The resultant light flux is indicated by fig. 1, where it is shown in a room, say, 10 ft. high and 20 by 20 ft. in area.

I think it will be agreed that the distribution of light would prove very satisfactory. The efficiency, allowing for 15 per cent. loss in the directive reflector, and 20 per cent. in the diffusive reflector, would approach 70 per cent.

The increase in efficiency of artificial light sources also tends towards the increase in power. Thus, it is not unlikely that some of what have hitherto been the favourite methods of interior illumination (such as the use of large numbers of small units placed adjacent to the objects they are required to illuminate) will have to disappear, and modern schemes on quite different lines will take their place.

THE DALMARNOCK POWER STATION.

Mr. W. W. Lackie, chief electrical engineer to Glasgow Town Council, addressed the City Business Men's Club in Glasgow recently, on the new Dalmarnock power station, which is now in course of construction. The first half of the plant will comprise five turbines of 125,000 h.p., and the second half four turbines of 200,000 h.p. Allowing one spare of each size, the station would meet a continuous demand if necessary of 250,000 h.p. The capital cost per horse-power for land, buildings, and plant, excluding mains, in the existing works, he said, was £12, and he did not anticipate any reduction in this capital cost on the first installation in the Dalmarnock works. The existing stations at Port Dundas and St. Andrew's Cross were overcrowded; the canal water at the former was now so much used for condensing purposes that its temperature had been raised to such an extent that machinery in the generating station could not be run in an efficient manner, and the extra coal which had to be used meant an annual addition of £30,000 to the coal bill. At St. Andrew's Cross the cooling towers were taxed beyond their capacity. On account of the ample water supply available from the Clyde, he estimated that a saving of at least £45,000 per annum would be made on the output at present given from the existing works. This would more than pay the interest on the capital now being expended on the Dalmarnock works.

The first half of the station would consist of two boiler-houses placed at right-angles to the engine room, each containing eight boilers, and the area of ground occupied by the houses would be about three acres. The turbine-room would ultimately be 450 ft. long, but the first section would be only 250 ft. by 75 ft. broad, or about two acres. A separate building would contain transformers and switchgear. The boilers would be of the Babcock & Wilcox water-tube marine type, and steam would be generated at 275 lb. per sq. in. pressure. The turbine-room would consist of two floors. On the basement there would be the condensers, circulating and air pumps, and other auxiliary machinery, and the main turbines and alternators would be on the upper floor. The best steam consumption yet obtained from a 6,000-H.P. turbine was in the region of 10 lb. per H.P.-hour; the 25,000-H.P. sets were guaranteed, under a penalty of £2,000 per one-tenth of a pound that they were in excess of 7½ lb. per H.P.-hour. This meant a saving of at least 25 per cent. in steam consumption, and, therefore, in the coal bill. From the labour point of view, one man could as easily look after a 25,000-H.P. turbine as a 6,000-H.P. set.

Electrical energy generated at 6,500 volts would be transformed up to 20,000 volts, effecting a great economy in copper. The 20,000-volt switchgear would be the first of its kind, and the first installation would cost £70,000. The spare ground at the site could be used for treating coal prior to burning it in the boilers, and also for electrochemical or electrometallurgical processes. The revenue of the department at present was £600,000 per annum, and when the first half of the Dalmarnock power station was fully in commission the electricity department would be the third Town Council department with a revenue of £1,000,000 per annum.

Mr. Lackie proceeded to discuss the report of the Sub-Committee of the Reconstruction Committee on Coal Conservation, the main conclusion of which was that the maximum economy of the nation's fuel wealth was to be best attained by a universal cheap supply of electricity throughout the country. The scheme outlined was on the right lines, but there would be sharply-defined differences of opinion with regard to the recommendations of the report, which dealt with the question of the ownership and control of the proposed large power stations. The report was quite evidently in favour of these large stations being under the control of private enterprise, while many felt that State or municipal ownership was the better policy. It was assumed that electrical supply could only be operated as a monopoly for two reasons—amongst others: electrical distribution necessitated access to streets and highways which were public property, and the supply of electrical energy was now a public service inseparable alike from industrial development and the amenities of life. The report not only suggested private ownership, but also hinted quite broadly at the need for State subsidy. His opinion was that municipal ownership was the correct policy. It was conceded by the people who lived outside the sphere of vested interests that gas, water, tramways, and electricity should be owned and operated by the local authorities wherever the local authorities were able and willing to do it. So far he had seen no argument in support of a departure from this policy in favour of the old policy of private companies managing public services. One thing was certain—the electrical industry had grown, while the Board of Trade had not. Both company and municipal advocates were agreed that the Board of Trade should have a strong electrical department properly equipped, and should look much more closely into electrical schemes and proposals before sanction was given for borrowing powers. If a cheap supply of electrical energy was available throughout the country, it was hoped that the burning of raw coal by private individuals and firms would cease almost entirely, and Glasgow might then realise one of the greatest desires of the Town Council—a smokeless city.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Openings for Trade in Palestine.

Very many thanks for the ELECTRICAL REVIEW, which has arrived regularly to date, sometimes much delayed as a result of more pressing business on hand, but always a welcome part of the mail.

I am now somewhere in Palestine, and often dream of the chances awaiting the electrical engineer who gets here first later on with resources. There are hundreds of pumping plants crying out for electric drive, and the abolition of messy internal-combustion. Gadgets run—until stopped by a movement of Mr. Atkins—on a wonderful mixture of crude oil and cruder gas, judging by the storage producers one runs across. All these contraptions bear a name-plate, which is anything but British, with a card of regulations governing the movements of the aforesaid printed in several languages, where, again, the British is conspicuous by its absence.

The general idea conveyed is that the agent who dumped the goods had the casting-vote in the lay-out of plant, and sowed his goods with a lavish hand. The idea of a central supply appears to be *non est*, possibly for obvious reasons. Maybe later on—but, there, the idea is being hammered in, and your journal is doing its share right merrily.

I trust these few remarks will escape the blue pencil, although sufficient has been said to prove the world-wide ramifications of one nation's trade in pre-war days. But seeing is believing, and a little reflection conveys some idea of the industrial "strafe" that is going to follow. Once more, let me convey my best thanks, and those of the many interested readers in our squadron, for your kind interest.

A. P. Holloway.

E.E.F., Palestine.

The 12½ per cent. Award and Clerical Staffs.

I have read with interest the correspondence in your columns with reference to this matter, and I shall be glad if you will allow me to point out to your correspondents what the actual position is as far as clerks are concerned in relation to this award, and to other awards of the Committee on Production.

These awards are issued in respect of applications made, and apply only to the classes of workers represented by the trade unions making the application. Clerks can obtain the 12½ per cent. if they make application through the National Union of Clerks, and already a considerable number of our members are enjoying this advantage. As long as clerks in the electrical trades remain unorganised they will be outside these awards.

Fred Hughes,
Assistant General Secretary.
National Union of Clerks.

13, Brunswick Square, London, W.C. 1,
February 27th, 1918.

The Organisation of Electric Supply Staffs.

I was interested to read "G's" letter in your last issue regarding the above, and would like to add my views on the subject.

As "G" points out, the expected developments in national electric supply may give rise to many questions which will involve the interests of both engineering and commercial staffs of electricity supply undertakings, and I think no time should be lost by the commercial staffs in organising for the protection of their interests. At the present time there is no organisation which the commercial staffs of electricity undertakings could join which would be of any assistance to them should occasion arise when the expected developments in national electric supply take place.

I would suggest that the reconstructed "Association of Electrical Power Engineers" might consider the question of forming a commercial section of their Association, comprising commercial assistants, chief clerks and others with technical knowledge employed in electricity supply undertakings. This would be far better than the formation of a new organisation for the commercial staffs themselves, and would enable both engineering and commercial staffs to combine in one for mutual protection of their interests.

Organise.

News from Ruhleben.

In a letter from Ruhleben, dated December 4th, 1915, which you were good enough to publish in your issue of December 17th, an account was given of the activities of engineers here, and of the inception of the "Technical Circle." The interest which, we venture to think, our colleagues at home would feel in any work such as ours, accomplished under abnormal and trying conditions, prompts us to offer them, through the medium of your hospitable columns, a further brief account of our activities during the past two-and-a-half years.

Intellectual activity in this camp has long since been strictly organised. It finds expression mainly through two channels, namely, the Ruhleben Camp School, whose chief object is systematic class teaching, and the Arts and Science Union, including its affiliated "Circles," whose object is largely education in the form of lectures. Practically all technical work of the latter form falls within the scope of four circles, which are, in the order of their formation:—

1. The Marine Engineers' Association (now a local branch of the M.E.A. at home).
2. The Technical Circle.
3. The Science Circle (the medium of the pure scientists and chemists in the camp).
4. The Woollen and Worsted Circle (devoting itself to problems of the textile trades).

The Technical Circle, which now numbers just 100 members, is fairly representative of the mechanical and electrical engineers in the camp. Our object is the exchange and mutual furtherance of technical knowledge. This is being achieved by holding for the most part weekly meetings, at which papers are read and discussed, and, further, by placing at the disposal of members such technical books and periodicals as are obtainable. Since the formation of the circle in July, 1915, 76 ordinary meetings have taken place, with an average attendance of 32 members. A complete list of all the papers read would encroach too much upon your space, but it may be mentioned that among the subjects that have been treated are:—Steam and water turbines, condensers, the Una-flow engine, various types of Diesel engines, electric generators, rotaries, and motors, switchgears, rheostats, and storage batteries, the applications of electricity in gold mines, in cane-sugar factories, in rolling mills, electric traction, electric welding, electric winders, electric furnaces, submarine cable laying, mining operations, mineral ores, air movers, the uses of oxygen, coal-gas, and liquid fuels. Subjects such as "Track-laying in Canada," and "Irrigation in the Soudan" further indicate the variety of the topics discussed. Debates, a "short-paper" competition, and "questions" evenings have occasionally varied the programme.

Quite a feature of this camp—and we believe of other prisoner camps, too—is the study of languages. Engineers here have shown considerable enterprise in this respect. Several technical lectures read in French have been keenly appreciated, and the arrangement of lectures in the Spanish and Russian languages is under consideration. German technical periodicals are also being read by a number of members.

The various resorts we have sought out for our meetings would appear sufficiently *bizarre* to a member of a home Institution. Our first paper was read in a dark corner of a dilapidated hay-loft, and, as the illustrative diagrams were only imperfectly illuminated by pocket lamps, the event was hardly deemed auspicious. An adjournment was made to a sheltered corner of one of the race-course grand stands. There, grouped on the concrete steps, in a manner reminiscent of the Athenian schools of philosophy, we listened to several lectures during the autumn of 1915. Winter drove us to seek a home in an inhospitable hall, used in the daytime for kinematographic performances; there we met for nearly 18 months. At length we were able to share in the modest equipment of one part of the school premises as a lecture room, and we are now, judging by Ruhleben standards, reasonably accommodated.

The preparation of technical papers is naturally getting increasingly difficult. We have reached a stage where we have almost exhausted the subjects on which our members may lay claim to speak with confidence, if not with authority. Under the circumstances, the Committee of the Circle is following the policy of scrutinising carefully every recent technical journal available, selecting therefrom questions and problems which are coming to the fore owing to the present situation (such as, for example, our fuel supply, means of developing our foreign markets, &c.), and requesting a member to read an abstract of a paper from a periodical, or to open a discussion on some such question. This policy we have found extremely instructive and fruitful. For this reason we wish particularly to thank those editors and publishers who have been kind enough to send us copies of technical journals through the Board of Education. These journals are circulated amongst the members on the system of the private magazine clubs at home, and are very greatly appreciated. Finally, we wish to thank those generous colleagues who have sent us technical books.

We shall soon be entering upon the fourth year of our existence as a Circle, and can look back with some gratification on the work that has been accomplished. It has not been our lot during this time to contribute directly to the advancement of engineering knowledge; but the will to carry on our work and the desire of members to contribute to our proceedings is an incentive to intellectual activity, and has helped in a measure to ward off the appalling state of mental apathy which so easily results from prolonged internment.

We admire more than words can tell the magnificent work done by our colleagues at home during the last three years. Our inability to assist in this work is felt by us all to be our greatest misfortune; it is a feeling which has increased our longing to enter once more upon a responsible occupation. We are earnestly hoping that the day when we can thus return to our legitimate work is not too remote.

We would like to take this opportunity of extending greetings to our colleagues at home, and of wishing them all success in the coming year.

William Eric Swale,
Hon. Secretary to the Committee
of the Technical Circle, Ruhleben.

Ruhleben Camp, *December* 21*st*, 1917.

[We are pleased indeed to hear from our fellow-countrymen who are so manfully enduring their long and weary confinement, and to know that their intellectual pursuits are so admirably organised and energetically maintained, in spite of the difficulties under which they labour. Their record is magnificent, and they have demonstrated afresh the indomitable spirit of the true Briton, who rises superior to all obstacles, and will endure to the end. We look forward to welcoming them home to assist us in the great work of reconstruction.—Eds. Elec. Rev.]

Office Organisation in Municipal Electricity Undertakings.

With reference to the article, entitled "Office Organisation in Municipal Electricity Undertakings," by Mr. G. W. Stubbings, which appeared in your issue of November 16th last, and which probably represents the views of all engineers, like myself, who are in charge of municipal electrical undertakings, I enclose, with the consent of the officer responsible for the finance of the Municipality with which I am concerned, his views on Mr. Stubbings's article, which was given to him for opinion.

I should be greatly obliged if you would kindly publish this letter, together with the enclosure, with the hope of eliciting further criticisms on the subject.

An Engineer-in-Charge.

India.

(Enclosure.)

The procedure in India is quite different to what it is in England, and the supervision by a company is far more rigid than that exercised by a local body. It is obligatory on the part of the directors to scrutinise expenditure closely, because they are responsible to the shareholders that the maximum profit is made from the undertaking. It would be a retrograde step to have a self-contained electricity department, (1) because of the cost, and (2) the absence of the detailed audit which the books of commercial firms go through by a firm of chartered accountants. The Government auditors do a test audit only.

WAR ITEMS.

New York Electric Signs.—New York's "great white way" along Broadway, which has been dim for several weeks, was to resume its brilliancy on March 1st, according to the *Times*, the Fuel Administrator having now permitted the use of electric signs.

Trading with the Enemy.—The "London Gazette" for March 1st contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Guatemala, Hayti, Honduras, Morocco, Netherland West Indies, Norway, Peru, Spain, Sweden, and Venezuela.

Affairs in Petrograd.—*Electricity Supply Failing.*—The latest mail advices from Petrograd on the fuel crisis say the scarcity of fuel becomes more felt day by day. The electric lighting stations work intermittently, and unexpected interruptions in the lighting are common occurrences. The publication of newspapers is seriously delayed owing to the shortage of current. A number of business concerns, particularly small ones, experience great difficulties for the same reason, whilst the town electric tramways are reduced to running short time, and look like stopping completely. The town water system is also seriously threatened through fuel scarcity.

Tramways Lack Competent Engineers.—The stoppage of tramway traffic in Petrograd is the result not only of insufficient fuel, but serious damage at the central station. One of the two new large turbines of the station not long ago got out of order, says the *Nash Vyek*, and it could not be put right by the present tramway board, in which there is not a single experienced engineer. Application had to be made to some private firms, but whether they understand the work is not yet quite clear. The tramways council of management, consisting only of workmen and controllers, are probably beginning to understand that without a scientifically-trained staff it will be difficult to run the business. Anyhow, the council is now trying to engage engineers.

German Industrialists' Plans.—"The methods and plans of the German industrialists are becoming more and more arrogant. Before the war large syndicates—especially the three largest Berlin banks—made several attempts to conclude a watertight agreement which would prevent any one concern from giving employment to the former employés of any rival concern. The Auxiliary Service Law was supposed to have provided adequate guarantees against all such tyranny. Now, however, a journal devoted to the interests of industrial employés has published a secret agreement concluded by 19 of the most important firms in the Berlin metal industry; they include the A.E.G., Borsigs, Siemens und Halske, the Siemens-Schuckert Works, and, indeed, all the well-known firms. The agreement, which took effect from January 1st last, provides that any firm which employs a former employé of another firm, unless the employé has been dismissed by his employer, shall pay a fine to the amount of twice the additional income earned by the employé during the first two years of his new employment. A particularly interesting feature of this secret agreement is that it is to hold good 'during the war with England'—a provision which throws a flood of light on the views of the German industrialists. It is 'the war with England' alone that determines all their calculations."—*The Times* ("Through German Eyes").

War-time Economy must be Permanent.—The Sheffield correspondent of the *Engineer* states that a question that has been raised there is of interest to other districts also. "It is this:—Is the enforced economy in the use of raw materials, in workshop methods, and in the disposition of labour, due to circumstances arising out of the war, to be maintained when peace comes? Viewed in the right light the prevailing rigid economy is a distinct acquisition. Before the war practically nothing was known of it. Here and there an iron or steel firm framed workshop rules which, carried out, were less wasteful than the average practice, but the spirit of carefulness that has been inculcated since the summer of 1914, if adhered to after the war, will play a very important part in the scheme of reconstruction. Sir Charles Allen, chairman of Henry Bessemer & Co., speaking at the shareholders' meeting, said that as to the future the signs were of a shortage of raw materials. There are very many in the steel trade who take the same view, and it will be remembered that Dr. Addison has expressed himself as being not at all certain that the fears of a fall in values at the end of the war will prove to be justified. Then there is the announcement of Sir Auckland Geddes. It therefore follows that unless the lessons of economy which are now being learnt are remembered and acted upon after the war the steel industry may find itself in a perilous condition; whilst, if any expansion policy is to be successful, it can only be by means of the most rigid permanent economy in raw materials. Moreover, it will hardly be disputed that the cutting out of wasteful methods of manufacture has resulted in the production of a better article, while the more economical use of labour has meant keeping skilled men strictly to skilled work, instead of allowing them to spend large portions of their time upon jobs that could just as well be done by semi-skilled or unskilled labour. Thus, in the scheme of reconstruction, this spirit of economy is destined to play quite as important a part as the more general introduction of labour-saving and output-multiplying machinery, and methods of specialisation and standardisation."

German Electrical Industry during the War.—The German electrical industry, states the *Norddeutsche Allgemeine Zeitung*, was one of the first to be able to accommodate itself to war requirements, partly because in time of peace it was already engaged on work for the Army and Navy. Before long, therefore, despite the depletion of staffs by mobilisation, the existing works were extended to turn out war work, and the expectations of the army authorities were exceeded. A still further increase of output would have been possible had it been necessary.

The electrical industry has provided for the needs of the army directly and indirectly. Under the first head it will suffice to mention wireless telegraphy, field telephony, searchlights, and marine requirements (including certain submarine requisites). In the electrotechnical branch also new demands have arisen, especially for the supply of substitutes to take the place of unobtainable raw materials. Work in the industry is plentiful; it must be remembered that without electricity not a single shell can be turned out, not an ounce of power ground, nor a gramme of nitrate extracted from the air. The works are indeed so busy that they have given up making articles unconnected with electricity, which were made in the earlier part of the war period in order to keep the factories going.

Technical progress has not been hampered by the war. Some of the largest plant in the world has been laid down during the last two years—no small feat when the scarcity of labour and materials is borne in mind. The industry has also surmounted the difficulties presented by the lack of imported materials (*e.g.*, copper, rubber, tin, mica, cotton, resin, and oils). The consumption of these commodities had to be reduced to a minimum, and where possible they had to be replaced by home-grown substitutes. This enforced policy will not be without advantage for German industry after the war, since some of the substitutes have proved equal and even superior to the imported substances.

Prices have been more influenced by wages in the electrical than, for instance, in the chemical, industry. In most other industries prices have been mainly determined by the cost of raw materials. In the electrical trade wages have been the determining factor, and the high wages have forced up prices. This is due in part to the influence of Berlin, where the Government factories, free from the considerations which must guide private concerns, have offered wages higher than anywhere else in the Empire. The war allowances to their employés have added to the expenditure of the private firms; yet, compared with other industries, prices in the electrical trade have been kept within moderate limits.

Prospects for the future are uncertain. It may be assumed that there will be an immense demand for electrotechnical products immediately after the war, so that if the requisite raw material is available the industry will be fully occupied. Whether the boom will continue after the home demand has been satisfied will depend on whether Germany is able to recover her old foreign markets or to acquire new ones. The electrical industry will be more than ever dependent on export trade if it is to retain its former importance.—*Board of Trade Journal.*

Exemption Applications.—At Rochdale, exemption to June 30th was given to the Corporation Tramways Committee for F. Walton (29, C 2), overhead linesman, and R. H. Hogg (38, C 1), motorman.

Before the Herts. Appeal Court, an appeal was made for F. Sandford (32, Grade 3), electrical engineer with Mr. J. B. Joel. It was stated that he had been discharged from the Navy as totally unfit, and was suffering from valvular disease of the heart. It was intimated that such men, discharged as physically unfit for the Navy, were not being called to the Colours pending further instructions. Exemption until August 27th was granted.

At Peterborough, the Electric Traction Co., Ltd., appealed for the retention of J. G. Manning (30, Class A). The manager claimed that the man was in a certified occupation; there were not sufficient cars run for the munition workers, causing the loss of a good deal of time, and things were getting much more difficult than they were. Owing to the shortage of staff, it now took them eight months to build a car. Major Deacon asked if there was not a wounded soldier who could be trained into this skilled work, and the manager replied, "Yes, if you can find us one." He added that Manning acted as a driver from 5.30 a.m. to 6 a.m. Conditional exemption was allowed.

The Oldham Tribunal has granted exemption until June 30th to two drivers on the Corporation tramways, one 37, in Grade 3, and the other 39, in Class B 2.

LEGAL.

F. D. Baldock *v.* the City of Westminster and the Charing Cross, West End, and City Electricity Co., Ltd.

At the Lambeth County Court, on Monday, Judge Hodges delivered a considered judgment in this action for damages to his cab through a collision near Trafalgar Square with an unlighted refuge in the street. A report of the case appeared in our issue of January 25th, page 79.

At the end of a lengthy statement, his Honour, having gone through the evidence very carefully, concluded he could not find a scintilla of evidence that this particular lamp had gone out before that particular night of the accident or that the defendants knew it had gone out or was likely to go out. Nor could he find any evidence that defendants knew, or ought to have known, that it had gone out on the night of the accident before the accident occurred. In the circumstances, he thought it would be unreasonable to hold that the defendants were bound to provide against the contingency of a particular lamp going out, and he did not think there was any evidence upon which a jury could find that the defendants were guilty of negligence in the omission to maintain a danger lamp on the refuge in question. He must, therefore, enter judgment for the defendants, with costs.

Thomson & Son (Motor Factors, Ltd.) *v.* Tarrant & Co.

In the King's Bench Division, on March 4th, Mr. Justice Roche had before him an action brought by Thomson & Son (Motor Factors, Ltd.), of Birmingham and Edinburgh, against Tarrant and Co., Queen Victoria Street, London. Plaintiffs claimed £427 10s. 5d. in respect of 11,324 pocket electric lamp batteries returned as faulty. The defence was that plaintiffs were not entitled to return 33⅓ to 40 per cent. of the batteries, as the seals had been broken contrary to the instruction on the carton.

Mr. Campion, for plaintiffs, read the contract, stating that plaintiffs were to be allowed to return faulty batteries. He said this matter had been before the Master, who made an order that plaintiffs might consent to final judgment for £285, and as to the residue of the claim that defendants should have leave to defend in respect of their contention that plaintiffs were not entitled to return the batteries, the seals of which had been broken. The plaintiffs denied that they had broken any seals. These were American batteries, and it was probable that they were a deck cargo, and that the seals had been broken during the voyage. But, in any case, the plaintiffs did not admit defendants' contention about the seals, relying on the terms of the contract that they were entitled to return any that were faulty.

Mr. H. S. Bond, district manager of the plaintiffs at Birmingham, said that he made the contract with the defendants. He supervised the unpacking of the batteries, of which 11,324 were defective. Many of the seals were found to be broken when the batteries were unpacked. He did not break any of the seals either in unpacking or in testing.

A demonstration was made to his Lordship in Court showing how, by means of an instrument, the batteries could be tested without breaking the seals.

The witness, in reply to his Lordship, said that before the war Germany held the market in these batteries, but after the outbreak of the war America began to send them. The Government allowed 50 per cent. of pre-war imports. Such batteries were now being made in this country.

In cross-examination by Mr. Phillips, witness said his firm did not allow batteries with broken seals to be returned. He attributed some of the broken seals in this case to damp, while others had been damaged on the voyage. The cases in which they came were not damp-proof because they were not tin-lined.

Justice Roche: This was a job lot—cheap, I suppose.

Witness: No; we paid 9s. 3d. a dozen, and they were sold retail at 1s. 3d. each. If the seals were broken, the wholesale people would send them back. Witness recognised that there was a custom in the trade that batteries with broken seals would not be taken back.

Mr. Phillips: Why did you not in writing to defendants say that the seals were broken?—In previous consignments we did not have 1 per cent. broken.

Is not that all the more reason that you should write about it?—They were advised that they were faulty.

The Judge: Do you suggest that he broke the seals?

Mr. Phillips: No: I have no evidence to show that. I say that a considerably greater number now have seals broken than was the case when the witness first examined them. Had there been as many he would certainly have written to say so. It transpired that litigation was pending between defendant and the company in America which supplied the batteries.

His Lordship said he hoped that this rubbish was sent before there was such a shortage of shipping, which he thought might be more usefully occupied. By rubbish he meant things that would not work or which were unimportant.

Mr. J. V. Farrant, one of the defendant firm, spoke of the custom in the trade not to take back batteries with broken seals.

In reply to his Lordship, he said he had a consignment of 900,000, and 200,000 were faulty.

Without calling on Mr. Campion to address him, his Lordship gave judgment. He said it was not disputed that a quantity of the batteries were faulty. The defence that plaintiffs were not entitled to return those the seals of which had been broken failed. He was satisfied that the plaintiffs never broke any seals. Defendants had got hold of a very bad lot. Apart from the fact that plaintiffs had not broken the seals, there was no contract between the parties that if the seals were broken plaintiffs were not to be allowed to send the batteries back. The dealer's notice on the carton was no part of the contract in this case. Judgment had already been signed for plaintiffs for £285, and he now gave judgment for them for an additional £142, making the whole of the sum claimed, £427.

Whittaker *v.* Accrington and District Gas and Water Board and G. Cunliffe & Sons.

At Accrington County Court, last week, Mrs. Margaret Whittaker, Church, sued the Accrington and District Gas and Water Board, and Messrs. G. Cunliffe & Sons, builders and contractors, Sidney Street, Accrington, for £50 damages for personal injuries. For the plaintiff, it was stated that she was walking on the footpath in Hyndburn Road, Accrington, in August last, and when she was crossing an electric inspection chamber there was an explosion within the chamber. She was thrown into the air, and landed violently in the middle of the road a few yards away. As a result of her injuries, she was unable to follow her work for some time. Opposite the chamber where the explosion occurred was an old mill in course of demolition by Messrs. Cunliffe. On the day of the occurrence some employés of the Gas and Water Board found a leakage of gas in a street some 300 yards away, and when one of the men applied a lighted match the explosion followed. On examining the ground near the old mill it was found that the gas service pipe was broken in two, which, it was contended, was due to Messrs. Cunliffe throwing stone, &c., on the footpath. For the Gas and Water Board, it was stated that there was no gas connection between the two places, but the workman who applied the light said he would not have done so had he known that the electric cables ran that way.

His Honour Judge Hugh Sturges said he was of opinion that the plaintiff was entitled to some compensation, but he would have to consider as to who was liable for the damage. He accordingly reserved judgment.

BUSINESS NOTES.

Controlled Supply of Accumulators.—We learn that restrictions have been imposed by the Ministry of Munitions (Priority Branch), 1, Caxton Street, Westminster, on the sale of accumulators. According to the Order, new accumulators can now only be supplied if the purchasers can furnish (1) a Class "A" certificate bearing a direct Government contract number; (2) a special permit issued by the Priority Department; or (3) an old battery in which the weight of lead exceeds the weight of lead in the new battery by 25 per cent. The new batteries will in this case be known as "replacements," and so neither certificate nor permit will be required.

Brazil.—According to a Consular advice, the gasworks having recently been closed, there is a likelihood of Maranham being illuminated by electricity, so that there will be a considerable demand for everything connected with electric lighting and also with electric traction. The Consul at Para has received an inquiry from an agent in Maranham who wants to represent British manufacturers.

He proposes to open spacious premises as a showroom, where samples, catalogues, and price lists can be shown. [Reference No. 44.].—*Board of Trade Journal.*

Liquidations.—Vaughan Engineering Works, Ltd., Cross Street, Islington, N. 1.—Creditors and shareholders met on March 1st, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. A compulsory winding-up order was made against the company last July, under which accounts had been prepared showing total liabilities £12,960, assets valued at £2,451, a deficiency of £7,147 in assets to meet the liabilities, and a total deficiency of £10,199 as regards contributories. Mr. W. J. Warley, Official Receiver, reports that the company was registered as a private company on May 21st 1914 with a nominal capital of £5,000, and was formed to carry on the business of electric lighting, heating, ventilating and general engineers. The purchase price was agreed at £3,000, and was satisfied by the allotment of fully-paid shares for that amount. The business was carried on with moneys borrowed on the security of debentures, and appears to have been carried on at a loss throughout. The failure of the company is attributed to losses on contracts due to incompetent estimating by the works managers, and to defective material supplied to the company for the contracts, in consequence of which work was rejected. The liquidation was left in the hands of the Official Receiver.

Rotherham Electrical Engineering Co., Ltd.—The meeting of creditors, called for last Friday, was adjourned for a week, no creditors being present. Unsecured liabilities about £1,000. The assets are book debts estimated at £200 and stock £100.

United Carborundum and Electrite Works, Ltd.—The Controller, Mr. C. Eves, has applied to the Board of Trade for his release.

Moonshine.—Messrs. C. A. Vandervell have sent us some copies of their useful moonlight chart for March.

Trade Announcements.—The Kingsway offices of Messrs. Malcolm & Allan, Ltd., have been taken over by the Government, and their new premises are at Goschen Buildings, 12-13, Henrietta Street, Strand, W.C. 2. Telephone: Gerrard 9486. Telegraph: Rheonalcom, Rand, London.

The Government having commandeered their offices in Imperial House, the National Carbon Co. (J. R. Morris) have temporarily removed to 50, Lincoln's Inn Fields, Sardinia Street, Kingsway, W.C. 2. Telephone number: "Holborn 248."

Messrs. D. H. Bonnella & Son have purchased the goodwill, stock, and plant of the foundry business of Messrs. Eagle & Co., 14, Hanway Place, W., and are retaining the services of all their employés. For the present the business will be continued at the old address, but communications should be sent to Messrs. Bonnella's offices, 58 & 60, Mortimer Street, W. 1.

Messrs. Malcolm & Allan, Ltd., of 499, Eglington Street, Glasgow, have been appointed sole agents for Scotland by Messrs. Automatic and Electric Furnaces, Ltd., for the sale of the Wild-Barfield electric furnaces and steel-hardening equipment. They are installing a demonstration plant at the above address, which can be seen in operation by any of our Scottish readers who are interested in the modern heat treatment of carbon steel.

A new company has recently been formed to take over the patents and goodwill of the R.E.T. Construction Co. Its name is Railless, Ltd., and it will work the R.E.T. system, which has been operating successfully for several years in various towns, including Leeds and Rotherham at home, Boksburg and Bloemfontein in South Africa, and Shanghai in China. At present the work of the company will be to a great extent preparatory.

Bankruptcy Proceedings.—A. E. Felgate, electrical engineer (trading with W. Storey as Felgate & Storey), Reading.—Bankrupt discharged conditionally by order made November 22nd, 1917.

Book Notices.—*Glover's Vade Mecum.* Manchester: W. T. Glover & Co., Ltd. Price 12s. 6d.—The new issue of this excellent handbook has been extended, and thoroughly revised. The copper and aluminium wire tables have been completely overhauled and arranged on a better system, with the British Engineering Standards incorporated, and the text has been largely rewritten, with additions, but rearranged so that much more matter is contained in the same space as before. The information given regarding the protection of underground cables and the methods of laying them is most complete and up-to-date, and the section on jointing cables is equally detailed and full of interesting matter, now including instructions for jointing 20,000 to 30,000-volt cables. The section on colliery cables has been almost entirely rewritten, embodying the wide experience acquired by the firm. The Home Office Rules for mine installations are now followed by the explanatory Memorandum. The section on overhead lines appears to be entirely new, and represents a great advance on the older version, and the section on the maintenance and testing of cable systems has been much improved; on the other hand, the part dealing with interior wiring installations has been omitted, but the I.E.E. wiring rules and other official regulations are given. As a whole, the book forms an admirable pocket companion for the engineer concerned with cables; it was good before, but in its new form, better arranged and printed, provided with thumb index, and brought up to date, it is worthy of the highest commendation.

"Clearing the Ground." By Lumberman. London: Constable and Co., Ltd. Price 7s. 6d. net.

Ignition Magnetos.—The latest addition to the growing list of British makers of ignition magnetos is the Britannic Electrical Co., Ltd., of Warstock, near Birmingham, who have lately produced a machine for use on motor cycles. It is to be known as the "Lion," and is stated to weigh only 5 lb. 3 oz.

Price of Aluminium in U.S.A.—A Reuter dispatch from Washington states that the President has fixed the maximum price of aluminium at 32 cents.

Catalogue.—The Renew Electric Lamp Co., Ltd., Trelco Works, Harrow Road, Willesden Junction, N.W. 10. Catalogue giving prices of refilling old and worn-out electric lamps.

LIGHTING AND POWER NOTES.

Australia.—In the annual report of the Adelaide Corporation reference is made to the Royal Commission which inquired into the question of municipalising the electricity services of the area. The findings of the majority of the Commissioners were :—That it is not advisable at present to municipalise the undertaking of the Adelaide Electric Supply Co., Ltd., but that legislation should be passed authorising the creation of a municipal trust with power in the future, when desired, to purchase the works of the company with the consent of a majority of the ratepayers interested, after the inspection of the company's affairs and publication of the results of the inspection to the members of the local governing bodies interested.

Barrow.—War Bonus.—The T.C., on Monday last, authorised the 12½ per cent. bonus to be paid to the electricity works employés.

Belfast.—On Monday, the Electrical Committee had under consideration Sir John Snell's report on electrical extensions. The original site for the new power station at Queen's Island having been acquired for shipbuilding purposes, another one, not far from the original site, has been secured, and on its erection and equipment will be spent the sum of £350,000, if Sir John Snell's recommendations are carried out in their entirety.

Birkenhead.—Price Increase.—The Electricity Committee recommends a further increase on pre-war rates of 12½ per cent. to ordinary consumers for lighting, an increase of ½d. per unit to consumers through prepayment meters, and 10 per cent. to ordinary consumers for motive power.

Birmingham.—Price Increase.—Owing to the continued increase in the costs of production, more particularly as to fuel, raw materials, and wages, the Electric Supply Committee has again revised the scale of charges for electricity to consumers. The increase is approximately 15 per cent. on the present scale of charges, which came into force last Michaelmas for low-tension supplies, and is considered immediately necessary. With regard to high-tension supplies, the Committee was advised that the Government Departments concerned were prepared to afford facilities to enable electric supply undertakers generally to revise all the pre-war or long-term agreements, with a view to consumers supplied under such agreements bearing an equitable share of the war burdens carried by electric supply authorities. It was obvious that the extra costs of production and supply should in equity, the Committee stated, be borne by all classes of consumers. In the case of high-tension consumers and the traction supply, the extra cost of fuel was already met by special provision in the agreements, but wages and other additional expenses were not provided for. The Committee, therefore, intended to raise the prices charged to high-tension consumers and for traction supply by 10 per cent., to be added after the Coal Clause had been taken into account. The deposit of a petition in opposition to the Bill of the Shropshire, &c., Electric Power Co. is recommended.

Bournemouth.—Price Increase.—The Bournemouth and Poole Electricity Supply Co., Ltd., announces a further increase in the price of electricity of 5 per cent. from the date of the December quarterly readings, 1917. This makes a total increase on pre-war rates of 25 per cent.

Brighton.—Price Increase.—The T.C. has decided to advance the price of electricity by 15 per cent., to meet the increased cost of fuel, materials, and labour.

Continental.—France.—Owing to the necessity of conserving electric power for war service, the province of Turin, France, has forbidden the use of electricity for any domestic purposes between the hours of 7 a.m. and 8 p.m.

Sweden.—With the object of increasing the capacity of the electric power station at Skultuna to the extent of 50 per cent., the Svenska Metallverkenbol, of Västerås, has recently purchased the undertaking of the Hornsjöförs works.

Darwen.—Price Increase.—The Corporation Electricity Committee has decided to increase the charges for energy by 20 per cent. all round.

Dublin.—Output.—The City Electricity Committee reports that the lighting units for the June quarter of last year showed a decrease of 152,000, and those for the September quarter a decrease of 82,000, as against the respective corresponding periods of 1916. The power units for the September quarter marked an increase of 75,000, but the net income was seriously affected by the general reduction in the use of electricity for lighting. The Committee is not presenting estimates of income and expenditure to the Corporation for the ensuing financial year. The public lighting estimate is given at £33,245, against £21,293 last year; and, in addition, the account to cover war bonuses is set down at £2,964.

Electricity is being installed in the factories of Messrs. Barrington & Sons, Ltd., soap makers, Great Britain Street.

Dundalk.—It was reported at the U.D.C. meeting that special adjustments were being carried out on the Diesel engines in the electric power station, by which it was hoped to reduce the consumption of ignition oil by over 75 per cent., thus effecting a saving equivalent to £600 per annum.

Dundee.—Proposed Extension.—The Corporation Electricity Committee, at its last meeting, agreed that a minor scheme of extension of the works at Carolina Port be proceeded with. Major Harry Richardson, Corporation electrical engineer, who is at present on furlough from the Front, and has been giving close attention to the extension problem, met the Committee and discussed matters with it. At the Committee meeting the hope was expressed that all questions of extension were being considered in relation to the Government's scheme for the establishment of high-power stations in the vicinity of coal mines. Major Richardson said that at the best the Government scheme would be a very lengthy job. They would have to start in the congested districts of England, and the nearest it would get to them for many years would be the Clyde Valley district. Continuing, the Major said they were entitled to ask what the Government intended to do for Dundee and district, and how long they would take to do it. They must go on in the meantime. Dundee power users knew at what rate they were getting their power just now, but they did not know what they would be charged for power under the Government scheme. It was explained that the extension agreed to would form part of the completed extension, so that the expenditure would not be wasted.

Regarding the extension, a correspondent in a Dundee paper revives an old proposal for using water power on the Tay in connection with the city electrical undertaking. He says:—"My plan would be to 'bridle' the rock at the Linn of Campsie by heightening the rock 10 ft. to 20 ft., which would make the river like a loch, with no danger of flooding." As far back as 1890 the same correspondent advocated a similar scheme to give sufficient power to generate electricity to supply Dundee, Perth, &c., and to work the trains on a local railway.

Hitchin.—Proposed Price Increase.—The Electric Supply Corporation has applied for consent to increase the maximum contract rate for energy to 9d. per unit.

India.—A licence has been granted to Messrs. Best & Co., of Madras, to supply electrical energy within the municipality of Trichinopoly, and Mr. Shokalingam Chettyar has been authorised to supply electricity within the Union limits of Karaikudi, in the Ramnad district.

During last month there has been a considerable change in the electric lighting in Delhi, the Local Government, in order to conserve coal, having introduced what is known as the summer scale of lighting, which consists of about one in three of the winter scale.—*Indian Engineering.*

Engineers' Conference.—The third Conference of Government Electrical Engineers has concluded its sittings. The most important business was a meeting, on three days, with a deputation from the Electric Supply and Traction Federation of India, who desired to discuss questions arising out of the provisions of the Indian Electricity Act and Rules and their administration. A deputation from the Bombay Chamber of Commerce and the Bombay Fire Insurance Agents' Association also attended, to put forward views concerning the identification of cables, the licensing of electricians, and the unification of installation rules. A further deputation of electrical contractors put before the Conference their views on certain trade problems in connection with the Government wiring specification. The remainder of the session was occupied with technical discussions and questions of administration.
Indian Engineering.

Liverpool.—Price Increase.—The Corporation has given notice of its intention to increase the charges for electrical energy for lighting, power and other purposes, as and from March 31st, 1918, or other the day on which the current quarter shall expire, by a further addition of 17½ per cent. over and above the addition of 12½ per cent. to the charges already in force.

London.—L.C.C.—Loan Sanction.—The Finance Committee recommends the sanction of the Council to the borrowing by the Islington B.C. of £3,571 for mains and transformers, and of £8,000 by the Poplar B.C. for two 1,000-kw. converters.

The Highways Committee reports that Bermondsey B.C. has given six months' notice to discontinue the agreement for the supply of electrical energy for Rotherhithe tunnel.

Londonderry.—Extensions.—The Coporation's Bill has passed the second reading in the House of Commons. The Bill, amongst other things, provides for the raising of a loan of £50,000 for electricity extensions.

Manchester.—Wages.—An application by the Corporation electrical workers for the 12½ per cent. bonus came before the Committee on Production last week. The Corporation stated that the bonus had been paid to all who were entitled to it. The men represented at the application could not legally claim that they were engaged on munition work, and were clearly not entitled to the award. If the application were granted to all who asked for it, the cost would be £148,000, or nearly 8d. in the £ on the rates.

Loan Application.—The Electricity Committee is recommending the City Council to apply to the L.G.B. for sanction to borrow £125,000 for the provision of plant at distributing stations and for extensions of mains.

Potteries.—Linking-up Scheme.—At the last meeting of the Stoke-on-Trent Electricity Committee, it was reported that at a meeting of the Newcastle-under-Lyme Council the agreement submitted was approved, and negotiations were being continued with respect to the Leek linking-up scheme.

Power Bills.—The Shropshire, &c., Power Bill.—Birmingham and Stoke-on-Trent T.C.'s have decided to oppose the establishment of a super power station at Stourport.

The Malvern U.D.C. has decided not to oppose the Bill in its present form.

Salford.—Bulk Supply.—The Electricity Committee has accepted an offer of the Manchester Corporation to supply electricity in bulk up to 2,000 KW. during the first year, 3,000 KW. during the second year, and 4,000 during the third year. The charges are to be for the first 2,000 KW., £2 15s. per KW. per annum: for the third 1,000 KW., £2 10s.; and for the fourth 1,000 KW., £1 10s., together with a charge of ·2d. per unit metered. The minimum annual payment to be for the first year £5,500, for the second year £8,000, and the third year £9,500. For every 1s. increase in the cost per ton of coal over and above the first 10s., ·013d. per unit is to be added to the charges. If the agreement is not renewed at the end of three years, any expense in recovering mains shall be borne by each Corporation in respect of the mains in their respective areas. The Salford Electricity Committee has accepted the offer of the Lancashire Electric Power Co. to continue to supply electricity in bulk for a further period of 12 months from April 1st, 1918.

Shipston-on-Stour.—The B. of G. has decided to take electricity for the workhouse from the Electrical Co. at 8d. per unit for lighting and at 5d. for power.

Todmorden.—War Bonus.—The T.C., last week, decided to increase all war bonuses granted to Corporation employés over 18 years to a total advance over pre-war wages of 16s. per week.

TRAMWAY AND RAILWAY NOTES.

B. of T. Tramway Conferences.—A Conference of representatives of the tramway undertakings in the Western Counties was held last week at the Grand Hotel, Bristol, the chair being occupied by Mr. James Devonshire, Chairman of the Tramways (Board of Trade) Committee.

The Chairman said it was of no use for the Government to tell them to maintain themselves if they could not let them have the wherewithal to do it, and he was glad to say there was evidence that something would be done with regard to the rolling stock and rails. In some cases it might be necessary to raise tramway fares. The law officers of the Crown thought they could not invoke the Defence of the Realm Act for that purpose, and the President of the Board of Trade had decided to introduce legislation in that respect. He suggested that resolutions that might be sent up on that point would very much strengthen the hands of the Board of Trade.

Mr. J. B. Hamilton (Leeds) dealt with the subject of labour. He said they would have to release more men by means of substitution or dilution and female labour. The Government would undertake any negotiations with Trade Unions. He added that National Service was going to make Labour Exchanges of vital importance.

Mr. A. L. C. Fell (London) dealt with rolling stock.

Mr. Samuel White (Bristol), responding to the chairman's invitation to speak, said the plan seemed an excellent one to bring the tramway industry together the whole country over. He thought one effect of the movement would be to bring the gentlemen connected with municipal undertakings into closer touch, perhaps with better feeling, with company undertakings. He could say that if there was anything that the Bristol company, being the largest undertaking in that area, could do to help its neighbours, it would be only too happy to do it.

It was resolved to form an Advisory Committee, consisting of the managing director or other officer of each undertaking, Mr. W. G. Verdon Smith, managing director of the Bristol Tramways Co., being unanimously elected as chairman, and Mr. W. E. Hardy, of Bath, as secretary.

Belfast.—At the monthly meeting of the Corporation, last week, it was stated that the financial condition of the tramway undertaking had greatly improved, and it was believed that it had successfully turned the corner. The scheme dividing the electrical department from the tramway department and placing each under a separate Committee was approved of.

Bolton.—Wages. — The Tramways Committee has referred to the Committee on Production an application for the extension of the 12½ per cent. war bonus to unskilled workers employed in the car works and on the repairs and maintenance staffs.

Darwen.—Year's Working.—The receipts on the main line of the Darwen tramways for the municipal year, which closed on February 28th, show an increase of about £2,000 compared with last year.

Edinburgh.—Prov. Order.—The Corporation is to apply for a prov. order to construct tramways from Edinburgh to Queensferry and Port Edgar.

Halifax.—Traffic Congestion.—The Halifax Chamber of Commerce was asked, last week, by Mr. J. W. Galloway, the Corporation tramway engineer, to recommend industrial firms to assist the tramway department in avoiding overcrowding and congestion on the tramways by varying, by a few minutes, the times of commencing and ending work, so that passengers would be distributed over different cars. The Mayor (Alderman H. Clay) supported the appeal, saying that it was impossible to put on more cars under present conditions. The Council of the Chamber decided to recommend manufacturers on the tramway routes to confer and endeavour to meet the need.

Hull.—From Friday, March 14th, onwards, all communications for the Corporation Tramway Department should be addressed to Tramway Power Station Buildings, Osborne Street, Hull.

Hutton Magna.—Application has been made to the B. of T., on behalf of the Hutton Magna Light Railway Co., for extending, for a period of one year from May 17th, 1918, the time limited by Sec. 19 of the Hutton Magna Light Railway Order, 1915, for the completion of the railway authorised by that Order.

London.—Tube Train Fire.—At the Hampstead tube station, on Tuesday evening, a train had just drawn up to the platform when a fire similar to that reported last week was observed in the driving car. The passengers were brought to the surface in the lifts without injury. Dense clouds of smoke ascended through the lift shafts into the street, and a large crowd gathered. The traffic was suspended whilst the damaged train was cleared.

Southport.—Year's Working.—The annual report of the Corporation tramways for the year ended March 31st last shows total revenue £20,962, working expenses (including £803 war service allowances) £13,917, gross profit £7,044: after deducting capital and other charges the net surplus totals £719, as compared with a surplus of £909 the previous year. Total number of passengers carried 5,020,088, as compared with 4,926,961. Average total revenue per car-mile, 10·865d.; average total expenses per car-mile, 10·076d.

Stoke-on-Trent.—The Council has deferred the sealing of the agreement with the Potteries Electric Traction Co. for an extension of the period of the company's running powers in the borough.

Threatened Tramway Strike.—On Saturday last, according to a decision arrived at by their Unions, the organised tramway and omnibus workers of the United Kingdom were to hand in their notices to cease work to-morrow, March 9th. They claim that the Askwith award of January 8th last, granting to commercial vehicle workers a wage equivalent to £1 per week advance over pre-war wages, shall be extended to them, and upon this issue a strike is threatened. Over 70,000 employés are affected. The National Federation of Transport Workers' officials declare that no compromise will be accepted, but, on the other hand, those who control the various tramway and omnibus concerns hope that arbitration may happily lead to a settlement. At a conference held some time ago to consider arrangements for the working of tramways, municipal and privately owned, a zone system was adopted, with the view of meeting the varying circumstances throughout the country, and the suggestion is made that these zone authorities might become the media for negotiation.

"Bonuses which have been granted are included in the £1 asked for, so that in many cases the demand will mean only an addition of a few shillings."—*Daily Telegraph.*

The threatened strike of tramway workers is causing some concern in Lancashire. The conference of Lancashire and Cheshire tramway authorities, 30 in number, some weeks ago, expressed willingness to submit the application to arbitration, and the delay has occasioned some surprise. At a meeting of the authorities on Friday it was decided to send a deputation to Sir George Askwith and Sir David Shackleton, with a view to getting the arbitration fixed as quickly as possible. Meetings of the tramway workers were held last week-end, and a strong lead was given to the executive.

The Leeds branch of the Tramway and Vehicle Workers' Union met on Saturday morning last to consider its position, in view of the national threat. The Leeds men are now getting 15s. per week and the women 12s. The drivers' total for a normal 60-hour week, with war bonus, is £2 12s. 6d., though overtime generally produces more. The women's earnings, in a normal week, are 39s. 6d. The meeting favoured the national demand, leaving the handing-in of notices to the officials of the Transport Workers' Federation. It is admitted that the new development is a considerable surprise to many of the tramway workers.

At a conference of the Amalgamated Association of Tramway and Vehicle Workers and the London and Provincial Union of Licensed Vehicle Workers at Leicester, last week, it was decided to tender seven days' notice, to expire on March 9th, unless a demand for £1 over pre-war rates and proportionate rates for overtime is conceded.—*Evening Standard.*

Walthamstow. — Women Drivers. — The Tramways Committee has received a letter from the Commissioner of Police stating that he is not yet in a position to give any decision with regard to the employment of women as drivers of electric tramcars. He also states that he has no power to issue a driver's licence to any person under 21. The Committee recommends that the Home Secretary be asked to take the necessary steps to give the Commissioner of Police authority to issue licences to women and youths under 21 as drivers of tramcars.

TELEGRAPH AND TELEPHONE NOTES.

Illicit Wireless.—Reuter reports that the Federal authorities in New York have seized the Tower Office Building on Lower Broadway, where a wireless apparatus was discovered sufficiently powerful to communicate with Germany. This wireless plant was in the possession of a certain Richard Pfund, who was at one time manager of the Telefunken plants at Tuckerton and Sayville. Athough the apparatus was disconnected, experts declared that it could be put into operation again within the space of half an hour. Pfund, when questioned on the subject, asserted that he was doing experimental work for the American Navy. This statement was subsequently verified, but the authorities are now making further investigations.

Russia.—The Great Northern Telegraph Co., Ltd., gives notice of an increase of rates to Russia, as from March 1st, to 5½d. and 1s. 4½d. per word for ordinary and urgent telegrams respectively.

Wireless Telegraphy.—Wireless communication has been established between San Diego, California, and Peking, a distance of roughly 7,500 miles, whereby daily communiqués are issued by the American Legation.—*Daily Mail.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Australia.—Melbourne.—April 5th. Department of the Navy. Motor-driven hydraulic pump.

June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Belfast.—March 13th. Tramways and Electricity Committee. Six or 12 months' supply of stores, &c. See "Official Notices" February 22nd.

Bolton.—March 18th. Tramways Department. Materials and stores for 12 months. See "Official Notices" to-day.

Dublin.—March 8th. Electricity Supply Committee. 1,760 yards of 3½-in. fibrous troughing. See "Official Notices" March 1st.

Fleetwood.—March 11th. U.D.C. Mechanical stoker for the electricity department. See "Official Notices" March 1st.

Lancaster.—March 18th. Tramways Committee. Supply of uniforms. See "Official Notices" to-day.

London.—Office of Works. March 13th. Six months' supply of electric bell fittings. See "Official Notices" to-day.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 12th. Corporation Tramways. (*a*) Permanent way special trackwork. (*b*) Copper rail bonds. General Manager, 55, Piccadilly, Manchester. Specifications for (*a*) 21s. (returnable).

March 13th. Electricity Committee. (*a*) Low-pressure valves for circulating water pipes for cooling towers. (*b*) Low-pressure water pipes and supports for cooling towers. Specification, &c., from Secretary, Electricity Department, Town Hall.

March 27th. Electricity Committee. Supply and laying of 33,000-volt E.H.T. cable. See "Official Notices" to-day.

Portsmouth.—March 12th. Tramways Committee. Six months' supply of tramway stores. See "Official Notices" February 22nd.

Spain.—April 2nd. Municipal authorities of Don Benito. Concession for the electric lighting of the town during a period of eight years.

Stockton-on-Tees.—March 14th. Corporation. Six months' supply of stores, &c. See "Official Notices" to-day.

CLOSED.

Government Contracts.—The contract secured by the Electrical Apparatus Co., Ltd., and mentioned under this heading last week, was for motor starters, not motors. The item was incorrectly stated in the official publication.

Glasgow.—The Tramways Committee has recommended acceptance of the following offers :—

Armature coils.—Mavor & Coulson, Ltd.
D.C.C. wire for field coils.—B.I. & Helsby Cables, Ltd.
Two sets of fuel economisers for Pinkston Power Station.—Clay Cross Co.

Ilford.—U.D.C. :—

General Electric Co., Ltd.—D.C. switchboard for sub-station, £286; two E.H.T. switch cubicles, £170.
H. Morris, Ltd.—7½-ton overhead travelling crane and rails for the electricity works, £106.

London.—Southwark.—Borough Council. Siemens Bros. & Co., Ltd. Cable, £106 and £38.

Salford.—Tramways Committee. Accepted tenders for annual supplies :—

Armature coils.—Dick, Kerr & Co., Ltd.; Manchester Armature Repair Co.
Field coils.—Manchester Armature Repair Co.; British Westinghouse E. & M. Co., Ltd.
Commutator spares.—A. Clare & Co.
Insulating tape.—B.I. & Helsby Cables, Ltd.; L. Andrew & Co.; General Electric Co., Ltd.
Air drying varnishes.—Griffiths Bros. & Co. (London), Ltd.
Dry cells.—Western Electric Co., Ltd.
Brake blocks.—National Railway & Tramway Appliances Co., Ltd.
Axle keeps and axle bearings.—Anti-Attrition Metal Co., Ltd.; G. W. Allsop.
Malleable iron castings.—Shotton Bros., Ltd.
Trolley heads.—G. W. Allsop.
Babbit metal.—Phosphor Bronze Co., Ltd.
Steel tires.—Hadfields, Ltd.; Cammell, Laird & Co., Ltd.
Trolley wheel bushes, &c.—Fleming, Birkby & Goodall, Ltd.
Gear wheels, pinion wheels, &c.—British Hele-Shaw Patent Clutch Co., Ltd.; Forest City Electric Services Supply Co.
Pitch, &c.—J. E. C. Lord.
Copper wire.—B.I. & Helsby Cables, Ltd.
Iron wire.—J. Kedd & Sons, Ltd.
Steel wire.—J. Bassett.
Lubricating oil and grease, cork, graphite.—Russell Oil & Chemical Co.
Lubricant colza and machine oil.—L. Bentley & Co., Ltd.

Wathamstow.—U.D.C. Brush Electrical Engineering Co., Ltd. New claw half-coupling for a 1,000-KW. mixed-pressure turbine, £75.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 8th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Salford Technical and Engineering Association.—Friday, March 8th. Visit to Messrs. Mitchell, Shackleton & Co., Vulcan Works, Patricroft.

Birmingham and District Electric Club.—Saturday, March 9th. At 7 p.m. At the Swan Hotel. Discussion on the "Decimal System."

Royal Institution of Great Britain.—Saturday, March 9th. At Albemarle Street, W. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, F.R.S. (Lecture IV.)

Institution of Electrical Engineers.—(**Manchester Local Section**).—Tuesday, March 12th. At the Engineers' Club. At 7 p.m. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(**Newcastle Local Section**).—Monday, March 11th. At the Mining Institute. At 6.45 p.m. Paper on "Switchgear Standardisation," by Dr. C. C. Garrard.

(**Western Local Section**).—Monday, March 11th. At the Merchant Venturers' Technical College, Bristol. At 5 p.m. Annual general meeting. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(**Scottish Local Section**).—Tuesday, March 12th. At Princes Street Station Hotel, Edinburgh. At 7 p.m. Paper on "Electrical Signalling and Control on Railways," by Mr. C. M. Jacobs.

(**Yorkshire Local Section**).—Tuesday, March 12th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "The Mechanical Design and Specification of the Turbo-Alternator Rotor," by Dr. S. F. Barclay.

Institution of Civil Engineers.—Tuesday, March 12th. At 5.30 p.m. At Gt. George Street, S.W. Exhibition of Kinematograph Films, Illustrating Water-power Works in Canada, by Prof. J. C. McLellan.

British Industries Fair, 1918.—At the London Dock, E. 1, Pennington Street Warehouse (close to Mark Lane Station). Monday, March 11th, to Friday, March 22nd. From 11 a.m to 6 p.m.

Association of Engineers-in-Charge.—Wednesday, March 13th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "The Superintendence of an Engineering Plant at a Large Hotel," by Mr. A. H. Barker.

British Engineers' Association.—Thursday, March 14th. Central Buildings, Westminster. Annual meeting. Address by Dr. Addison.

Institution of Mechanical Engineers.—Friday, March 15th. At the Institution of Civil Engineers, Gt. George Street, S.W. General meeting.

Linking-up in Germany and Hungary.—According to the Stuttgart *Neues Tagblatt*, a meeting of representatives of all electric central stations in Württemberg, Germany, was held recently at Geislingen, at which it was decided to unite under a single management. Lines will be laid interconnecting the various power houses, and arrangements will be made for the most effective and economical production and distribution of the energy generated. A Committee of Representatives has been appointed to work out details for the incorporation of a separate distributing company which will handle the entire production and assign the quantities of energy to be produced by each. Although this situation has been created by the extraordinary war conditions, it is the intention of the Committee to make the arrangement permanent if it proves satisfactory.

A Bill has been passed in the Hungarian Parliament, says the *Budapester Hirlap*, providing for the combination of all electric central stations of the country into one huge organisation. A central management is to take hold of the work, and all cities and towns in Hungary will receive energy for lighting and power from it. The main object is to relieve power houses which are overworked and to assist those in which the demand is not equal to the available supply.—*Electrical World.*

NOTES.

The Industrial Reconstruction Council.—This Council is holding a meeting at the Town Hall, Manchester, on Wednesday, March 13th, at 3 p.m., under the auspices of the Lord Mayor. Mr. G. H. Roberts (Minister of Labour) and Sir William M'Cormick (Department of Scientific and Industrial Research) will be the leading speakers. This is the first of a series of public town's meetings in great industrial centres arranged by the Council with the object of awakening national interest in the vital industrial problems of the immediate future. Applications for tickets should be made to the Secretary to the Council, 8, Bouverie Street, London, E.C. 4.

Applications to the Board of Trade for Increase in Maximum Prices.—Electric supply companies who are making application to the Board of Trade for revision of maximum prices scheduled in their Provisional Orders, or who propose doing so, will be interested in the following communication from the Board of Trade, received by Mr. T. W. Cole, Secretary of the Provincial Electric Supply Committee, with regard to a conference with the Board of Trade on January 16th. The letter sets forth the various particulars required to be furnished by such companies, and the procedure necessary with regard to giving notice to the local authority interested, and runs as follows :—

With regard to the revision of maximum prices, I am to state that the Board have given careful consideration to the suggestion made at the conference that a general Order should be made in the matter, but they are satisfied that the adoption of such a course is not practicable, and that each case must be considered on its merits under the procedure prescribed by the Companies' Acts and Orders.

I am to state that the Board will deal as expeditiously as possible with any application which they may receive for a revision of maximum price.

Each company, when submitting an application, should furnish particulars on the following points :—

1. The amount of dividend paid on the ordinary shares for each of the last five years of account.
2. A comparative statement of receipts and expenditure for the last five years respectively.
3. The proportion of energy supplied respectively—
    (*a*) To contracts with controlled establishments.
    (*b*) Under long-term contracts.
    (*c*) To ordinary consumers.
    (1) For lighting, and (2) for power, with a statement of the prices now charged in respect of each class of supply.
4. The increase in revenue charges per unit generated attributable to increased cost of wages, fuel, oil and plant since the outbreak of war (exclusive of the increase of wages due to the recent award relating to the 12½ per cent. bonus).
5. What the recent 12½ per cent. bonus award will represent per unit generated.

Each company should, at the time of making the application, serve a notice thereof on the local authority for every district in their area of supply, which notice should state that the Board will be prepared to consider any representations which may be made to them in the matter if received within 14 days of the date of the notice.

I am to add with regard to those cases where charges are made to consumers on the maximum demand system, that the Board are of opinion that any general percentage increase which may be added to the consumer's account to cover war contingencies, should not be taken as infringing the provisions relating to maximum price contained in the Companies' Acts and Orders, provided that the average charge per unit to any consumer does not exceed the maximum prescribed.

Industrial Research and the N.P.L.—In a lecture at the Royal Institution, last week, Sir R. T. Glazebrook gave some particulars concerning the future of the National Physical Laboratory. From April 1st its property, now vested in the Royal Society, will be vested in the Imperial Trust for the Encouragement of Scientific and Industrial Research, and its income, including receipts from fees, will be vested in, and under the control of, the Committee of the Privy Council for Scientific and Industrial Research. The scientific control of the Laboratory will continue to be exercised by the Royal Society, and the management will remain in the hands of an Executive Committee appointed as heretofore, and containing representatives of the great technical societies. In the future, as in the past, the Laboratory will endeavour to discharge two functions—it will be a laboratory of industrial research and a national testing institution or proving house. It will be organised in eight different departments, each with its own superintendent and a large staff of scientific assistants and observers. The staff now numbers well over 500 persons, of whom about 180 are women, and the expenditure, which was £5,479 in 1900, will be considerably over £100,000 during the current financial year.—*The Times.*

Economise Gas and Electricity!—In view of the necessity of reducing the consumption of coal, and the labour and transport to handle it, Mr. Guy Calthrop, Controller of Coal Mines, draws the attention of all consumers of gas and electricity throughout the country to the need of the greatest possible economy in their use. He appeals to all classes of consumers to see that every gas burner and electric switch over which they have control is used as sparingly as circumstances will allow. The need for this economy is accentuated where large cities and towns are remote from coalfields, as is the case with London and other cities and towns in the South. As regards lighting, we must limit ourselves to a bare sufficiency, and avoid any approach to brilliant illumination, whether in our dwelling-houses, shops, or public buildings.

Volunteer Notes.—London Army Troops Companies. Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 16th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Second Lieut. E. A. Ullmann.

Next for Duty.—Lieut. C. E. Campbell.

Monday, March 11th.—No. 3 Company, 6.30 8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, March 12th. Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 13th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 14th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 15th.—Musketry, 5.30—8.

Saturday, March 16th.—Entrenchments, &c., for the whole corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

An Italian Treason Trial.—Proceedings have been commenced by the Genoa Military Tribunal against the German-Swiss Lokker, a director of the Genoa Electric Works, and Louise Martin for high treason, and against Hubert, the foreman of the works, for damaging the plant.—*Times.*

Samples of Foreign Manufactures.—It will be remembered that not very long after the outbreak of war the Board of Trade Commercial Intelligence Department collected together large numbers of enemy manufactures which had been sold or offered in this country and in Colonial and foreign countries. A fairly representative and interesting exhibition of electrical apparatus and accessories, which was held in Cheapside, formed part of the Department's useful activities in those days. Since then representative collections of the samples brought together in this way have been sent to different parts of this country and to Canada, and we have no doubt that they have been of assistance to manufacturers in various branches of trade. There has now been established on the top floor at 73, Basinghall Street, a Foreign Samples Exhibition, where some of the electrical lines referred to above, and a host of other things such as toys, buttons, paper clothing, small tools, and so on, can be seen by manufacturers and exporters who are interested in knowing the quality, design and style of goods produced by enemy countries to meet the demands of other markets. Some information can be obtained at the exhibition concerning the prices at which certain of the goods were sold, names of British manufacturers of similar lines can be ascertained, and names of probable overseas buyers also. Indeed, a great deal of valuable commercial information can be obtained there—that fact impresses us more than does the handful of electrical articles that are displayed—and we hope that our firms will show an increasing desire to avail themselves of the services which the Department of Overseas Trade, under the controllership of Sir W. Clark, is desirous of rendering. Altogether, the collection consists of about 10,000 articles, and not the least interesting of these are to be found among the 1,000 samples of goods produced by enemy countries during the period of the war.

Shop Stewards in Engineering Works.—The *Times* Manchester correspondent reports that 14 societies connected with the engineering trade, representing 800,000 members, have balloted on the question of including shop stewards among Trade Union officials, and the returns from 11 of the societies show the large majority of 16 to 1 in favour of the proposals. Among the workers who have given their decision are the electricians, tool makers, smiths, strikers, ironworkers, brassworkers, core-makers, enginemen, firemen, finishers, motormen, and labourers.

The functions of the stewards, says the correspondent, so far as they are concerned with the avoidance of disputes will be on the following lines :—

"A workman or workmen desiring to raise any question in which he or they are directly concerned shall in the first instance discuss the same with his or their foreman.

"Failing settlement the question shall, if desired, be taken up with the management by the appropriate shop stewards and one of the workmen directly concerned.

"If no settlement is arrived at, the question may, at the request of either party, be further considered at a meeting to be arranged between the management and the appropriate shop steward, together with a deputation of the workmen directly concerned. At this meeting the organising district delegate may be present, in which event a representative of the Employers' Association shall also be present.

"The question may thereafter be referred for further consideration in terms of the provisions for avoiding disputes.

"No stoppage of work shall take place until the question has been fully dealt with in accordance with this agreement and with the provisions for avoiding disputes."

Tin and Tungsten Research Board.—As the outcome of a conference held on November 7th, 1917, a fund for research has been raised, and a Research Board has been appointed by the Committee of the Privy Council, with Sir Lionel Phillips as chairman. The Board has authorised extended lines of research with a view to increasing the recovery of metal in the treatment of ores.

Appointments Vacant.—Wireman as instructor for training classes for the Wolverhampton Education Committee; two switchboard and sub-station attendants (50s. to 65s.), for the Borough of Salford Electricity Department; armature winder (1s. 3½d. per hour), for the Coventry Corporation Tramways; four wiremen (55s.), for Military Camps in the Winchester District; meter tester (£3), for Corporation of Greenock Electricity Department; meter tester (50s. + 12½ per cent.), for Rochdale Corporation Electricity Department; mains superintendent (£234), for Stoke-on-Trent Corporation Electricity Department; wireman, for the East Sussex County Asylum; wireman, for the Stepney B.C. Electricity Works; draughtsman (£182), for the South Shields Borough Electricity Department; charge engineer and fitter (67s. 5d. + 12½ per cent.) for the West Bromwich Corporation Electricity Department; junior shift engineer (£130) for the Borough of Dover Electricity Works. See our advertisement pages to-day.

Electric Furnace Progress.—The year 1917, says a writer in the *Sheffield Telegraph*, is a landmark in the industrial history of the world on account of the remarkable advance witnessed in the making of electric steel. In the course of the 12 months the number of electric furnaces in operation or being installed increased from 470 to 750. In this progress the most prominent part was taken by the United States, which stands easily first with 233 furnaces, including the largest plant in the world. Canada's furnaces in five years have grown from three to 54, these having an output capacity of 173,000 tons of iron and steel, 50,000 tons of ferro-silicon, and 8,000 tons of ferro-alloys. Great Britain is now second in the list as regards the number of furnaces, having 140; this country is only just realising the immense possibilities of electric furnaces for steel and castings. The serious deficiency of hematite iron will give the electric furnace an excellent opportunity of proving its value. The New York *Iron Age* estimates the number of electric furnaces in use in Germany at 91; Austria, 31; France, 50; Sweden, 50; Italy, 40; Russia, 21; Norway, 12; Switzerland, 4; and Japan, Spain, and Denmark, 2 each.

The need of very high-grade alloy steels for aircraft has given a great impetus to the electric furnace industry in Sheffield. Some of these steels can only be successfully made in the electric furnace, but it is not yet realised that all steels—except the very cheap basic qualities—can with advantage be treated electrically, either completely melting or refining hot metal only.

One firm in the States has under installation a number of furnaces of 15 and 25 tons capacity. The American Navy Department has adopted an English type of furnace—the "Greaves-Etchells"—and is building a number of six-ton units for the Navy yards. The same furnace has also been adopted by Dr. J. A. Matthews, of the Halcomb Steel Co., and by the American Radiator Co.

Throughout America the steel makers are hastening to place themselves in a position immediately to meet the expected call for vast quantities of electric steel on the return of peace. British progress would undoubtedly have been much more marked had not the movement received a check some 12 months or more ago. Numerous applications for permits to install furnaces have been turned down. As a result, many firms desirous of providing themselves with electric melting plant have deferred the matter until the embargo is removed, although they are quite satisfied that for future business the electric furnace is essential for the success of the British steel industry.

New electric furnaces have successfully been started up at the Leyland Motor Works, Leyland, and at Messrs. Stewarts & Lloyds, Ltd., Glasgow. The type in each case was the 3-ton "Greaves-Etchells" furnace; they will both run on high-grade steel castings.

British Industries Fair.—The British Industries Fair opens on Monday next, March 11th, at the London Dock, Pennington Street, London E. 1, and remains open until March 22nd daily from 10 a.m. to 6 p.m. The exhibitors of electrical articles include the British Ever-Ready Co., Ltd., the Efandem Co., Ltd., Metallic Press Work Co., Ltd., Rose Bros., and Ward & Goldstone. There is also a large number of exhibits of electrical and engineering glassware. The right to exhibit has been confined to manufacturers, of whom 425 are present.

Institution and Lecture Notes.—Chief Technical Assistants' Association.—At the meeting held on Saturday last the election of officers took place, with the following result:—

Chairman ...	... Mr. H. F. J. Thompson (Battersea).
Vice-chairman	... Mr. J. H. Parker (Croydon).
Hon. treasurer	... Mr. J. R. J. Bowden (Hackney).
Hon. secretary	... Mr. A. P. MacAlister (Islington Borough Council, 50, Eden Grove, Holloway, N. 7).
Committee ...	... Messrs. J. T. Baron (St. Pancras) and J. G. Doran (Bermondsey).

As a result of the expressed desire of the chief technical officers in various undertakings in the United Kingdom, the Association has now extended its membership to undertakings outside the area of Greater London, to which originally the membership was confined. As a result of this extension, and with the support which is foreshadowed, the increased membership will be considerable, and it is believed that it will materially assist in the formation of the future Institution or Association, which is at present being formed. The Association has expressed the desire that any senior technical officer of the grades eligible for membership, whether connected with a municipal or company electric supply, or a traction undertaking, who has not yet received any communication, or who has not communicated with the hon. secretary, will send his name to the hon. secretary.

During the coming session of the Association, many papers on technical matters, especially relating to electricity supply undertakings and their working, will be read and discussed at the meetings. This particular feature of the Association is one which has proved of extreme value, and is most highly appreciated by the members, as it has been very beneficial to assistants in their professional duties, and it is hoped that a scheme, whereby the members of undertakings outside the London area will also be able to benefit equally, will be formulated.

Chadwick Public Lectures, Swansea.—A course of three lectures on "Electricity and National Progress" will be delivered at the Albert Minor Hall, Swansea, on Fridays, March 8th, 15th, and 22nd, by Mr. H. T. Davidge, B.Sc., M.I.E E.

The 12½ per Cent. Award.—Mr. H. Faraday Proctor, hon. secretary of the Incorporated Municipal Electrical Association, in a letter to the engineer members of the Association, states that the attention of the Council has been drawn to the fact that some persons have construed his circular letter dated January 21st as indicating that the Council is not in favour of payments being advanced to members of the staff receiving a salary exceeding £500 per annum. He points out that the Council makes no suggestions of limitation in this matter, and is desirous of ascertaining, for the benefit of members, what action has been taken in the various undertakings. Inquiry is therefore made as to the classes of employés to whom the 12½ per cent. award, other bonuses, or equivalent, have been paid.

British Engineers' Association.—Dr. Addison, Minister of Reconstruction, will give an address at the annual general meeting of this Association, to be held at Central Buildings, Westminster, on Thursday next, March 14th.

B.A. Meeting Cancelled.—The meeting of the British Association which was to have been held at Cardiff this year has been cancelled.

Australian Industrial Organisation.—Among the decisions of the Australian Trade and Industry Conference are the establishment of a Science and Industry Institute, thoroughly equipped and staffed, and in close touch with the Department of Commerce and Industry and the various industrial associations, and the appointment of trade representatives in the principal oversea markets.—*Times.*

Experiments on Electroculture.—Writing to the *Times Engineering Supplement* of February 22nd, a correspondent discussed the experiments in electroculture carried out by Mr. S. E. Britton, electrical engineer to the Corporation of Chester, and chairman of the I.M.E.A. Committee for the Development of Electricity in Agricultural Areas, suggesting that Mr. Britton, in his report (published in our issue of February 1st, 1918), had undervalued the work done in this connection, including his own, and that the results obtained did not justify his conclusion that the subject was still in the experimental stage, and that much remained to be done before the general application of any such artificial aid to crop growth could be recommended to agriculturists. The writer held that the results obtained were quite good, and clearly demonstrated the beneficial effect of the electric discharge upon crop production. He further stated that arrangements were being made to apply electroculture to an area of 100 acres at Pershore during the coming season, and urged that if electrical manufacturers would concentrate on commercial, rather than experimental, apparatus, at a moderate price, it might be possible for farmers to utilise the system without waiting for the formulation of standard rules for its application.

Replying to this criticism in a letter to the *Times*, Mr. Britton said that it appeared to him that the correspondent had gone out of his way to submit a misleading interpretation of his (Mr. Britton's) report on the Chester experiments and views concerning electroculture, and had attempted to show by inference that the electrical equipment which was being used for this purpose was a sound engineering job from the agriculturist's point of view, and that the subject was sufficiently well understood to warrant adoption on a commercial scale.

With regard to the results of the Chester experiments, he did not consider that these materially assisted in elucidating the reason for the varying results hitherto obtained, but rather tended further to confuse this complex subject. It might, however, be inferred from the results that each variety of potato grown under electroculture required different electrical treatment; should that be the case, then it might further be inferred that other crops would also require different treatment; but, judging by what had already been achieved, there was justification for thinking that when the electrical requirements were more definitely known, and apparatus was made to produce what was known to be required, then electroculture might be expected to achieve abounding advantages to a densely-populated island country such as this. It could not be too clearly stated that there was no published information of any definite form of apparatus required for any particular crop, neither would any manufacturer of the apparatus which was being used for electroculture definitely state what it was capable of producing, and neither could a manufacturer concentrate on commercial apparatus when its requirements could not be defined. It would, therefore, be absurd to expect an agriculturist to make use of such apparatus on a commercial scale. What was required for further progress was scientific knowledge of the fundamental principles concerning plant life when under the influence of an electric discharge. Until such time, the public should not be encouraged to take up electroculture, and practical experiments should be confined to areas of two to five acres at different parts of the country.

"The reference to the recently-appointed Advisory Committee of the Board of Agriculture I heartily endorse. In March, 1917, the Incorporated Municipal Electrical Association formed a Committee for the Development of Electricity in Agricultural Areas, with power to co-opt members of other societies interested in the subject. The Committee, as now constituted, has representatives of agriculture, botany, engineering, and electricity supply. As chairman, I take this opportunity of pointing out that the Committee was brought to the notice of the Board of Agriculture. For practical purposes it is a pity that it was not consulted, or some member of it appointed to the official committee. Further, most of the members of the I.M.E.A. Committee are having, or have had, experience of the apparatus and of the actual growing of crops, whereas, as far as I am able to ascertain, Prof. Blackman is the only member of the Board of Agriculture Advisory Committee with any experience either of growing crops with electric discharge or of the apparatus required, or of the difficulties which occur in practice.

"The I.M.E.A. Committee is now carrying out experiments to determine the electrical requirements necessary to set up and maintain a definite quantitative electric discharge under different atmospheric conditions. Designs have been prepared for electric ploughing, and cheap and efficient means of supporting overhead transmission lines upon farms. Other important matters connected with electricity in agriculture are receiving the attention of the Committee, and when manufacturers are in a position to undertake new work the Committee hope to make more rapid progress. At a recent meeting a resolution was passed to discourage, for the time being, the adoption of electroculture for other than experimental purposes."

The Restrictions on the Use of Lead-Covered Cable.—Correspondence has taken place between Mr. Thos. Roles and the Secretary of the Cable Makers' Association with regard to the difficulty under which the majority of electricity supply undertakings are now working owing to the fact that, in view of the shortage of lead, the Ministry of Munitions is refusing to grant sanction for the use of lead-covered cable in connection with the extension of mains and the installation of services, except in cases in which the extension or the service is required for urgent war work.

A very great proportion of the undertakings in the country have been using paper-insulated and lead-covered cables throughout on their underground mains systems, and, in view of the restrictions, any extensions and probably repairs to such systems for some considerable time to come will have to be effected by the use of cable which is not lead covered.

Mr. Roles put several queries to the Association, in reply to which the Secretary of the C.M.A., Mr. Ll. B. Atkinson, wrote that in the opinion of his Association it was most important that every possible effort should be made to maintain continuity in the design of cables in use, and suggested that even where the use of lead-covered cables was in the first instance refused by the Ministry of Munitions, in important cases it would be well to make other applications, as it was not believed that the Ministry would desire to run risks of breakdown arising from mixed-up systems. Failing this, however, the Association suggested the following:—

1. That paper-insulated bitumen-sheathed cables should be used up to, say, 2,200 volts.
2. That bitumen-insulated cables should be used for low-pressure work only.
3. That rubber-insulated cables should be used for low-pressure work only.
4. For services the Association suggested bitumen or rubber cables laid in earthenware troughs or drawn into stoneware or cast-iron pipes.

Further, in every case where these formed part of a system where metallic bonding was used, it was desirable either that these other cables should be used with a wire armour or other metallic sheathing, or that they should be drawn into bonded cast-iron pipes, these sheathings and the pipes being connected to the general bonding system. Rubber cables, unless armoured, should not be put into cast-iron or other pipes except for short services.

It was not to be taken that the above list represented in order the merits of the alternatives, and the statement as to pressures must be taken to be general, as in individual cases it might be possible to increase, or in some cases necessary to diminish, those pressures.

With further reference to this subject, the Cable Makers' Association expressed the opinion that it was impossible to obtain satisfactory substitutes for lead-covered cable for extra-high or high-tension work, and that wherever cables were connected to a system where metallic bonding was used, such cables should have steel tapes or wire armouring connected to the general bonding system. Mr. H. Faraday Proctor has ascertained from the Director of Electric Power Supply that, in cases where non-lead-covered cables are used, there will probably be no difficulty in obtaining the authority for steel armouring.

The Council of the I.M.E.A. also holds the opinion that no cable other than that which has a lead sheathing should be used on E.H.T. or H.T. work, but that a leadless cable may be used for low-tension work, provided that it is furnished with armouring and is properly bonded.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—A bonus of £100 has been this week granted to Mr. J. B. PATTERSON, acting electrical engineer to the Lancaster Corporation, in recognition of his extra services last year during the absence of the engineer, Major G. C. Milnes, M.C., who is fighting with the Royal Lancaster Regiment in France.

By 20 votes to nine, the Edinburgh Town Council has approved an increase in the salary of Mr. NEWINGTON, the resident electrical engineer, by £100, to £950.

Mr. G. A. ROBERTS, acting electrical engineer at Doncaster, who has been with the Corporation for 14 years, has resigned.

Mr. W. GLAZIER, second charge engineer to the Ilford undertaking, has resigned on account of ill-health.

Mr. C. H. BUILT has been appointed manager of the Worcester tramways by the Worcester Electric Traction Co., Ltd., in succession to Mr. R. Simpson. He has been in the service of the company since 1904.

General.—To prevent confusion with an electrical firm of similar name, Mr. W. LANGDON-DAVIES has ceased to use this form of signature, and in future wishes to be addressed as "Walter L. Davies."

Sir CHARLES A. PARSONS, K.C.B., F.R.S., has ratified his acceptance of election as a vice-president of the recently-inaugurated North-Eastern Section of the Junior Institution of Engineers.

Barnsley Education Committee has appointed Mr. HERBERT LEIGH, of Brighton, as teacher of a training course in electrical engineering for disabled sailors and soldiers, at a salary of £15 per calendar month.

A presentation of a gold watch has been made to Mr. G. RIDEOUT, foreman of 30 Shop, Messrs. Siemens Electrical Works, Stafford. The gift, which was made on behalf of the employés by Mr. W. Newman, was to mark their esteem for Mr. Rideout on his departure, after 10 years' service as foreman, to take up an appointment at Wolverhampton. The staff of Messrs. Siemens presented Mr. Rideout with a gold albert.

Mr. WADESON, who was with Mr. W. M. Selvey, consulting engineer, of Sheffield, has been gazetted captain.

Mr. HARTWELL CONDER, formerly Tasmanian State mining engineer, has been engaged by the Tasmanian State hydro-electric department to make a geological survey of the storage area of the proposed King River hydro-electric power scheme, designed to supply power for mining and metallurgical works at Zeehan and other parts of the West Coast.—*Australian Industrial and Mining Standard.*

Roll of Honour.—The Croix de Guerre for gallantry in the field has been awarded to Bombardier H. BROMLEY, R.G.A., who was on the staff of the West Ham Corporation tramways.

Private C. H. BURCH, Queen's Royal West Surrey Regiment, who has died of wounds, was for 15 years with Messrs. Tamplin & Makovski, electrical engineers, of Reigate.

Mr. W. CRELLIN, lost in the sinking of the transport *Tuscania*, belonged to Whitehaven, and enlisted whilst an electrician at Detroit, Michigan.

Second-Lieutenant J. HARDIE, R.F.C., who has been killed whilst on a flight from Birmingham to Oxfordshire, was formerly with Messrs. Fraser & Chalmers, of Erith.

The death in action is reported of Lance-Corporal LOVELADY, Rifle Brgade, who was employed by the Haslingden Corporation electricity department.

Sergeant R. TOOTILL, R.F.A., who has been awarded the Military Medal, was employed in the instrument testing department of Messrs. Ferranti, Ltd., Hollinwood.

Private J. HALL, Loyal North Lancashire Regiment, who is officially reported to have died in a German hospital from wounds received in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private J. FISHER, Manchester Regiment, who has been killed in action, was an employé of the British Westinghouse Co., Trafford Park.

Second-Lieutenant S. L. STERN, formerly an assistant engineer with Mr. David Alexander, electrical engineer, Glasgow, has been accidentally killed whilst making a flight in this country.

Lance-Corporal H. NICHOLL, West Yorks. Regiment, who, after being missing, is now stated to have been killed, was engaged with Mr. James Tate, electrical engineer, Bradford.

Obituary.—MR. E. N. GREAVES.—The *Times* "Deaths" column contains a notice to the effect that Mr. Edward Neville Greaves, A.M.I.E.E., passed away on March 2nd at Elm Lodge, Town Close Road, Norwich, aged 43 years.

Mr. T. H Higham.—The death has taken place, at the age of 52 years, of Mr. Thomas Henry Higham, for over 26 years chief electrician to Messrs. C. Tinling & Co., of Liverpool.

Will.—The late Mr. J. S. Sellon, a director of Messrs. Johnson, Matthey & Co., Ltd., left £159,044 gross and £157,880 net personalty.

NEW COMPANIES REGISTERED.

Bristol Institute of Electrotherapeutics, Ltd. (149,723).—Private company. Registered February 27th. Capital, £1,000 in 750 15 per cent. cum. pref. shares of £1 each, and 5,000 def. shares of 1s. each. Objects, as indicated by the title. The subscribers (each with one pref. share) are:—A. G. Partridge, 10, Highcroft Villas, Brighton, certified masseur, National Hospital; Mrs. J. Martin, 33, Holland Road, Hove. The first directors are: W. J. M. Martin and Winifred Higgs. Manager: W. J. M. Martin. Registered office: 22, Holland Road, Hove, Sussex.

Helix Heater Co., Ltd. (149,716.—Private company. Registered February 26th. Capital, £3,000 in £1 shares. To take over the business of a manufacturer of fireproof porcelain for gas and electric heaters, and tiles carried on by the Helix Heater Co. at Wilnecote, Staffs. The subscribers (each with one share) are:—T. W. Robinson, 63, Temple Row, Birmingham, solicitor; J. Dixon, 60, Frederick Road, Stechford, Birmingham, solicitor's clerk. The first directors are to be appointed by the subscribers. Registered office: Prudential Buildings, Corporation Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

A. Vernon-Ward (Manchester), Ltd.—Debenture dated February 15th, 1918, to secure £250 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Rosenberg, 259, High Holborn, W.C.

Brecknell, Munro & Rogers, Ltd.—Memorandum of satisfaction in full on February 1st, 1918, of debenture dated December 5th, 1912, securing £500, has been filed.

Bastian Electric Co., Ltd.—Issue on February 18th, 1918, of £250 debentures, part of a series of which particulars have already been filed.

Hampson Bros., Ltd.—Mortgage dated January 21st, 1918, to secure all moneys due or to become due from the company to Parr's Bank, Manchester.

CITY NOTES.

Crossley Bros., Ltd.

Sir Kenneth Crossley, in addressing the annual meeting, said that the company were absolutely full up with enough work of the highest national importance to keep them going for the rest of the year. The results for 1917 showed a small improvement on the previous year. They had not made excess profits, but there had been a further big increase in the turnover. They had adopted the right and prudent course in not paying a larger dividend, because of the uncertainties of the future, including the problems of reconstruction, difficulties of changing back from war work to ordinary work, scarcity of raw materials, shortage of shipping for export, and a probable world shortage of capital. Referring to recent discussions about a levy on capital, Sir Kenneth said:—"Naturally the proposition sounds most attractive on the surface to so-called wage earners, but if they will only go a little deeper and study the economics of the question, I think they may alter their views. Putting aside the obvious injustice of confiscating the property of a very large class of people—many of them not so well off as those earning high salaries, or fees, or wages, and the impossibility of realising a fair proportion of such a levy in a useful form—nothing would do more harm to the confidence and credit which our country, above all others, is so dependent on. Surely this war, when we have won it, must be paid for by an expansion of our industries and by the free development of our Empire's enormous resources, and not by discouraging all incentive to individual effort—nothing in the end would react so disastrously on all those who labour with hand or brain."

London Electric Supply Corpn., Ltd.

For 1917 the profit on working is £64,793 (against £55,214 in 1916), plus £7,068 brought forward, less £347 interest on temporary loan. Debenture interest and sinking fund absorb £40,074; 5 per cent. is to be paid on the preference shares, against 4 per cent. for 1916, and £8,980 is to be carried forward. Supply has been efficiently maintained. Units sold 49,013,606, against 49,810,105; total costs per unit sold .79d., against .80d. last year. Average receipt per unit sold (lighting and power) 1.06d., against 1.02d. Expenses of generation, owing to war (principally coal and wages), show an increase of 77 per cent. compared with 1914, viz., from £67,693 to £119,961, while the units sold increased 5 per cent., viz., 46,343,065 to 49,013,606. At the annual meeting on February 26th, Mr. R. H. Benson, who presided, emphasised the importance of cheap supply of power in the London district ready, when peace comes, for reconstruction, that is, for productive purposes in order to repair the waste of the war. The increase of nearly £10,000 in profit was due partly to increase of price for current sold (£217,478 as compared with £212,328), and partly to decreased cost of generation (£119,961 as compared with £127,897). They had had a 150 per cent. rise since 1914 in the price of coal, and 75 per cent. in the cost of labour. There was still 1 per cent. more to be earned before the preference stock got its due, viz., 6 per cent., and, of course, as usual, there was nothing for the ordinary stockholders of the oldest of the London electric supply companies. If in the fourth year of universal war they had been able to more than hold their own, they might look forward with confidence to the future of the corporation when once normal conditions were re-established. Only one thing was needed—a relaxation of the shackles with which, in the imaginary interest of the consumer, the development of power production had been confined from the beginning. That was the point of public interest. It was Parliament's inveterate fear lest the producer should make too much money out of the consumer. As their ordinary stockholders well knew, the producer had not had any sort of return for his enterprise and his cash; the consumer had had it all. Looking back and reading the lesson of history, it was easy to say now that two mistakes were made: (1) Parliament forbade the London companies to amalgamate for the purpose of cheaper production; (2) Parliament reserved an option of purchase now vested in the L.C.C. on the basis of a break-up valuation of the plant in 1931, and no man could say how that valuation would work out. With such uncertainty ahead, when it was necessary to borrow money to pay for more plant, &c., to meet the demand for power, a London company could not offer a security that was certain to be repaid in 1931. "Was it good public policy to keep the London power companies poor, checking their development in order to have the option of buying them up cheaply? The difficulty increases as the day approaches. Instead of first-class, up-to-date plants, the L.C.C. might end in finding only antiquated plant to buy up. But it is not too late." The general principles of the report of the Coal Conservation Committee suggested the formation of new authorities for the generation and distribution of electric supply from large power stations. The suggestion was not a new one. As far as London was concerned, 10 years ago the London electric supply companies, after a considerable amount of negotiation amongst themselves, promoted a Bill in Parliament for the purpose of amalgamating their undertakings, and for working them on the lines generally laid down in the above report. Had that Bill passed, London by now would have had the advantage of one of the cheapest supplies of electric power in the world, with immense saving in coal consumption. Parliament, however, refused its sanction. Yet, in spite of the limitation of their area of supply, the shortness of their tenure, and the withholding from them of the power to amalgamate, they might claim that the average charge for electricity in London compared not unfavourably with that elsewhere, either in this country or any other. For example, the average price per unit received by the London Electric Supply Co. for its total output of units in 1914, viz., 46,000,000, was .94d., while the energy sold for power purposes averaged under ¾d. per unit; and, but for the war, they would by now have reached the minimum amount mentioned in the Coal Conservation Committee's report, and that without enjoying the monopoly which that report now positively recommended. The board would feel nothing but satisfaction in seeing this great and urgent problem tackled on lines so nearly identical with their own suggestion of 10 years ago, and if they were invited to assist in carrying out such a scheme, they would most gladly bring all the resources of their experience and inside knowledge of the conditions into co-operation.

Mr. R. Stewart Bain, the managing director, said that the capital expenditure during the year was £33,000, of which nearly £30,000 was on account of the new 10,000-kw. turbo-generator. This plant was now running. During the year 2,339 h.p. of motors had been connected to the industrial power supply, bringing the total to 20,441 h.p.; orders for an additional 771 h.p. had since been received. The revenue account showed an increase in receipts amounting to £5,600, and a decrease in expenditure of nearly £4,000. Coal was less by over £12,000, not because the price was lower, but because of a satisfactory reduction in consumption owing to the efficiency of new plant brought into commission during the year; and the operation of a coal clause which they had incorporated in all new power contracts, the effect of which was that the consumer paid for the extra price of coal above a standard rate, the receipts therefrom being deducted from the amount paid for coal. Great difficulties continued to be experienced in getting deliveries of coal. The increase in wages since the war started amounted to 74 per cent. as compared with 1914.

Metropolitan Electric Supply Co., Ltd.

Capital expenditure during 1917 increased by £24,754. Gross revenue £318,216, an increase of £40,307. Working expenses £184,543, an increase of £23,534. Balance before providing for depreciation £133,674. £50,000 has been set aside for depreciation and reserve, which fund now stands at £427,359. Including the balance brought forward, interest, and other receipts, £98,224 is available, out of which debenture and loan interest and preference dividend are paid, also a total of 4 per cent. for the year on the ordinary shares, leaving £4,926 to carry forward. New connections 1,414.5 kw., making the total 40,948 kw. The Rt. Hon. F. Leverton Harris, having accepted office in the Government, has resigned his position as a director. Mr. E. Cunliffe Owen, C.M.G., who had been in the service of the company for nearly 30 years, has retired owing to ill-health; Mr. F. Hipwell has been appointed secretary in his place. In order to provide additional working capital, and to pay off loan from bankers, a new issue of debentures, called "Extension Debentures, 1917," amounting to £500,000, has been created, of which £250,000 was issued during the year. Arrangements have been made for the acquisition of approximately the whole of the preference and ordinary capital of the Uxbridge & District Electric Supply Co., Ltd., as at December 31st, 1917, and the purchase will be completed immediately. Meeting: March 11th.

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. J. Winkworth, presiding at the annual meeting on February 27th, said that the number of new consumers was again less than might have been expected, owing to war restrictions on material, &c. To meet conditions, charges for lighting supply had been slightly increased, and the rates to consumers generally had been revised to meet increased production costs. Receipts from sales of current increased by £33,258; units sold were approximately 47 per cent. better than in 1916, and 100 per cent. better than in 1915. Owing to the large bulk supplies the average price obtained fell from 1.6d. to 1.5d. The cost of coal increased by £26,773. There was still difficulty in getting delivery of plant required at the power-house. In regard to the West Kent Electric Co., the number of consumers increased from 1,062 with 3,989 h.p., to 1,092 with 5,599 h.p. The gross revenue rose from £27,677 to £45,139, the expenditure from £22,245 to £38,126, and the net revenue from £5,432 to £7,012. In view of the rapid growth of the West Kent Co.'s business. it applied to Parliament for the removal of restrictions as to capital and for other purposes, and the Royal Assent was given last May. The company had since purchased the freehold of a suitable site, with considerable frontage to the Lower Thames, upon which it was proposed to erect a large power-house to deal with the business on comprehensive lines. It would be built upon the most up-to-date lines, and arranged in self-contained sections. It would be of such size as to make it commercially advantageous for the undertakings adjoining to take supply in bulk rather than to continue their existing small generating stations. Plans were being prepared so that everything might be ready to make a start as soon as opportunity offered. It might not be necessary to add to the plant at the South Metropolitan Co.'s power-house after the present orders were completed, except for the erection of a third large turbine and boilers. The prospects for the current year, so far as gross revenue was concerned, were favourable. Important new business had been secured, but the delay in delivery of power-house plant delayed connections. Mr. H. W. Bowden, the engineer-in-chief, followed with a statement regarding the general working, and produced a number of interesting figures.

Notting Hill Electric Lighting Co., Ltd.

During 1917 the connections increased from 241,859 to 252,307 (30-watt), and the profit from £23,306 to £24,270. The consumers number 4,546, and, with the exception of 18, they are supplied at 200 volts. Revenue from sale of current was £47,916, an increase of £4,731, and the gross profit increased by £964. There has been put to depreciation, renewal and reserve fund £3,000; debenture interest required £1,920; interest and sinking funds for Kensington and Notting Hill Joint Debenture stock amounted to £3,796; income-tax £4,721; distributed under staff co-partnership scheme £166. After paying 6 per cent. on the preference shares, and 3s. per share, less tax, on the ordinary, £1,757 is to be carried forward. The report states that the war bonus to the employés has been increased to 20s. a week, and by a subsequent decision the Government requires electricity supply undertakings to pay a special bonus of 12½ per cent. on all earnings (wages and bonuses), such payment to date back as from October 13th, 1917. To meet this, and the general increase in cost, the company is raising the charge for electricity by an additional 1d. per unit from April 1st, 1918. The case of the Kensington & Knightsbridge Co. respecting the question as to the right of the company to supply current outside the northern boundary of the Notting Hill Co.'s area otherwise than from the joint works, had resulted in judgment in favour of this company, except on two minor questions. The period allowed for an appeal has not yet expired. Units generated or purchased, 3,525,640; units sold, 2,578,295. Annual meeting: March 12th.

Underground Electric Railways Co. of London, Ltd.—The net income for 1917 on revenue, &c., was £602,718, and, after paying interest on 4½ per cent. bonds, 4½ and 5 per cent. notes, Central London guarantee payment, and interest on the 6 per cent. first cum. income debenture stock, 1 per cent. per annum, plus income-tax on the 6 per cent. income bonds, is paid, leaving a balance of £31,140. The income from investments, &c., showed a decrease of £46,631, mainly due to the reduction in the dividends of the L.G.O. Co. from 8 per cent. to 7 per cent., and the Associated Equipment Co. from 14 per cent. to 12 per cent. The aggregate gross revenue of the five companies parties to the common fund authorised by the Act of 1915 was £6,661,863, and the aggregate amount retained by them for revenue liabilities, including reserves, was £6,141,526, leaving £520,337 to be credited to the common fund. This amount was apportioned amongst the five companies as follows:—City & South London Rly., 6 per cent.; Central London Rly., 20 per cent.; London Electric Rly., 30 per cent.; Metropolitan District Rly., 12 per cent.; and L.G.O. Co., 32 per cent. Further extensions of the Associated Equipment Co.'s factory at Walthamstow were carried out during the year, thereby enabling the company largely to increase its output of motor vehicles; but the full benefit of these extensions will only be obtained during the current and subsequent years.

Tyneside Tramways & Tramroads Co.—Presiding at the meeting, Dr. J. T. Merz said that the receipts altogether were something like £11,500 higher than a year ago, the greater part of this increase being received during the latter half of the year; further, the income was still increasing. The greater part of the increase—about 85 per cent.—was from ordinary traffic, probably due to the fact that the railway traffic had been very much reduced, and was more expensive than trams, and also because there was no facility for river traffic. The directors had not hitherto thought it right to deal liberally with the available balance because of the expenses that would be incurred as soon as the war was over in relaying the track; therefore it had been necessary to build up a considerable reserve fund and suspense account, but now there was a sufficient balance left to warrant them in increasing the dividend and paying a bonus. The dividend of 5 per cent. on the ordinary shares compares with 3 per cent paid last year.

Newcastle & District Electric Lighting Co., Ltd.—Adding to the gross profit for 1917 £29,979 brought forward, and deducting interest on debentures and loans, the available balance is £51,096. A dividend of 2½ per cent., less income-tax, is paid, £2,539 is transferred to second mortgage debenture redemption fund, £500 is written off debenture issue expenses, £29,222 is transferred to depreciation and renewals reserve, and £13,257 is to be carried forward. The company has suffered from the continued rise in the cost of wages and materials. £3,000 of the 6 per cent. second mortgage debentures were redeemed during 1917.

Tramways, Light & Power Co., Ltd. — At the recent annual meeting, Viscount Chilston said that, notwithstanding the difficulties, they were able to report very substantial progress. The income from their undertakings showed an increase of £6,943, and the administrative expenses were £1,100 higher. In his opinion, the company was so securely established that shareholders could look forward to the regular payment of the preference dividend half-yearly. The gross receipts for a number of years showed the steady progress of the company:—1913, £14,756; 1914, £28,047; 1915, £30,501; 1916, £35,287; 1917, £42,238.

Oxford Electric Co., Ltd.—Profit for 1917, including £645 brought forward, £11,367. After paying the debenture and preference interests, 5 per cent., less tax, on the ordinary shares, putting £416 to reserve and renewals, and writing £450 off hire-purchase installations, £751 is to be carried forward. Revenue from sale of electricity advanced, but the profit seriously diminished, owing to cost of labour, fuel, and commodities generally.

Bruce Peebles & Co., Ltd.—The trading profit for 1917 was £23,617. After deducting administration expenses, interest accrued on unsecured debentures, and depreciation, the net profit is £14,584, which is subject to excess profits duty and control taxation for 1916 and 1917. The results are considered satisfactory having regard to the abnormal times and difficulties. Annual meeting: March 15th.

Davis & Timmins, Ltd.—Net profit for 1917, including £23,070 brought forward, after allowing for depreciation and other charges, £84,247. Dividend for the year, 8 per cent., free of tax, and a bonus of 17 per cent., free of tax, carrying forward £59,983, subject to special taxation.

British Insulated & Helsby Cables, Ltd.—Final dividend of 7½ per cent., together with a bonus of 10 per cent., making 25 per cent. for the year, against 20 per cent. for 1916.—*Financial Times.*

Electrical & Industrial Investment Co., Ltd.—Dividend, 5 per cent. on the preferred ordinary shares, carrying forward £13,469.

Bournemouth & Poole Electricity Supply Co., Ltd.—Final dividend on the ordinary shares at the rate of 7 per cent. per annum, less tax, for the December half-year, making 6 per cent. for the year

Para Electric Railways & Lighting Co., Ltd.—Owing to the delays in mails the audited accounts from Para have not yet been received, and in consequence the report for the year ended November 30th last and the payment of the usual dividends on the preference and ordinary shares have to be postponed.—*Financial Times.*

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in:—

Marconi International Marine Communication Co., Ltd.—250,000 additional shares of £1 each, fully paid (Nos. 350,001 to 600,000)

South London Electric Supply Corporation. Ltd.—For 1917 the gross receipts were £66,658, and the expenditure was £35,717. Including £3,053 brought forward, the amount available is £33,994. After putting £7,000 to depreciation, paying the 6 per cent. preference dividend, also debenture and other interest, £2,500 is put to general reserve, 5 per cent. is to be paid on the ordinary shares, and £3,125 is to be carried forward New connections representing 24,741 lamps (35-watt), or 870 KW., were added during the year, making 417,740 lamps (14,600 KW.). Units sold 7,549,945—increase 851,588, or 12.7 per cent. Units generated 9,611,090. Meeting: March 12th.

STOCKS AND SHARES

Tuesday Evening.

The visit of the "Tanks" to the City has not had the unfavourable effect upon business in the Stock Exchange which most of us expected. Indeed, business in gilt-edged securities is fairly good, prices are well maintained, and even the Russian affair is momentarily relegated to the background as a bear point. Confidence appears to be returning to various sections of the Stock Exchange, which is another way of saying that there is more business about. Industrials continue to command the greatest part of the activity prevailing, but so far as electrical issues are concerned, there has been something of a decline in the shares of the manufacturing companies, more especially those which were run up sharply two or three weeks ago.

The report of the Underground Electric Railways Co. was not received with unmixed satisfaction, and hints were thrown out that there might be a protest at the meeting this week in regard to the interest on the Income Bonds being no more than 4 per cent. The meeting, therefore, is awaited with more than usual interest. Lord Farrar's reference to the probability of fares being raised has had the effect of putting up the price of the company's £10 shares to 1¾, thus showing a rise of 2s. 6d. on the week, but the 1s. shares are weaker at 5s., and the Income Bonds at 79½. Districts are dull at 15; Metropolitan Ordinary Stock is ex dividend. The Surplus Lands is better at 49.

Dividend declarations come freely from the electric supply companies. The City of London has declared a dividend of 10 per cent., making 8 per cent. for the year, the same as before. The South London is paying 5 per cent., the South Metropolitan 6 per cent., which is an increase of 2 per cent., and the Notting Hill Co. announces 3s. a share. The South London will distribute 5 per cent. on its Preference, against 4 per cent., and the dividend on the St. James's and the Westminster Companies of 11 per cent. and 10 per cent. respectively make 9 per cent. for the year in both cases, as against 8 per cent. and 7 per cent. for 1916. The market is steady as a whole, except in the case of City of London Ordinary, where a couple of hundred shares came in. This was something of a line for times like the present, and the price receded ¼ to 13.

The Westminster Electric Supply Corporation is inviting the holders of its 3½ per cent. Debenture Stock to accept 97 for their security now, instead of waiting until March, 1920, when the stock will be repayable at 100. Having regard to the anxiety of everyone to do as much as he can in the way of taking up National War Bonds, it is likely that the company's suggestion will be readily accepted, because the option is, if anything, slightly in favour of the proprietors taking advantage of the offer. Incidentally, the inference is obvious that the Westminster Corporation must be in an excellent financial position to be able to repay in cash the debentures still outstanding.

The feature amongst stocks and shares connected with the cable industry is a further rise of 50s. in Henley's to the round £20 per share, due, of course, to the exceeding juiciness of the melon which the company is cutting for the benefit of its shareholders. The savour has spread to Callender's, and has caused a rise in them of 30s. India-Rubber shares are also 5s. up at 15. On the other hand, the electrical manufacturing group, as already pointed out, has given way, and British Westinghouse Preference lost the 3/16 which they picked up last week, the price having receded to 2 15/16. Electric Constructions weakened to 25s. Edison Swan fully-paid fell to 2½, and other members of the group are also out of favour for the time being. Marconis have improved to 3 1/16, but the market for American Marconis is dull at the moment, and the price, after being 25s. 3d., has gone back to 24s. 9d. United River Plate Telephones fell 3/16 to 6 13/16 on a few sellers coming to market simultaneously, and in the general list of cable stocks no other changes have occurred.

London United Tramways Debenture is in considerable demand, and the price, which stood at 30 not long ago, has risen to 42½, without tempting out any noticeable amount of stock. Much curiosity is expressed as to what may be in the wind to account for this sudden revival. Amongst the foreign issues, Mexican Tramways Common receded to 28. British Columbia Deferred, after being 30, fell back again to 28, but the company's Preferred Stock is a point to the good at 31½, and the Preference shows a similar rise at 53.

Rubber shares are weak and friendless, notwithstanding a rise in the price of the material to 2s. 5½d. per lb. Shares are freely offered, and buyers are coy. There has been an all-round improvement in the shares of the gunpowder companies included in what is known as the combine, advance details having leaked out as to what the various companies are likely to receive when the new concern makes its appearance. Armaments, on the other hand, have reacted. Base-metal shares are mostly firm, but there is nothing of outstanding interest upon which to comment.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1915.	Dividend 1916.	Price March 5, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref..	4½	4½	3	— ¼	7 10 0
Chelsea	4	8	2⅞	—	5 4 4
City of London	8	8	18	— ½	6 3 1
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 6 0
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅝	—	5 11 7
London Electric	8	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅛xd	—	8 0 0
Metropolitan	8	8	8¼	—	4 12 4
do. 4½ per cent. Pref.	4½	4½	8½	—	6 13 4
St. James' and Pall Mall ..	8	8	7⅛xd	—	6 6 4
South London	5	5	8	—	6 18 4
South Metropolitan Pref. ..	7	7	21/-xd	—	6 13 4
Westminster Ordinary	7	7	6⅝xd	—	6 18 4

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price March 5, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	33/6	1½	12⅜	—	5 18 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	6	7	9¼	—	*7 11 4
Eastern Extension	8	8	16¼	—	*5 6 0
Eastern Tel. Ord.	8	8	152½	—	*5 5 7
Globe Tel. and T. Ord.	7	7	14¼	—	*4 18 3
do. Pref. ..	6	6	10⅛	—	5 15 5
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	18	18	51½	—	6 6 8
Marconi	10	15	3 1/16	+ 1/16	4 18 0
Oriental Telephone Ord. ..	10	10	4⅛	—	2 17 2
United R. Plate Tel.	8	8	6 13/16	— 3/16	*5 17 4
West India and Pan.	6d.	6d.	1⅛	—	*2 19 2
Western Telegraph	7	8	15½	—	*5 5 0

Home Rails.

	Dividend 1915.	Dividend 1916.	Price March 5, 1918.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	62½	—	6 9 1
Metropolitan	1	1	21½xd	—	4 13 0
do. District	Nil	Nil	15	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1¾	+ ⅛	Nil
do. do. "A" ..	Nil	Nil	6/-	—8d.	Nil
do. do. Income	6	4	79½	— ½	*5 0 8

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916	Price March 5, 1918.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2⅜	—	—
do. 5 Deb. ..	5	5	66½	+ ½	7 10 6
Brazil Tractions	4	4	45	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	53	+1	9 8 8
do. do. Preferred	Nil	Nil	31½	+1	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	84½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	88	—	—

Manufacturing Companies.

	Dividend 1915.	Dividend 1916	Price March 5, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	8 5/16	—	4 10 4
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	8¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	— 3/16	5 2 0
Callenders	20	20	17½	+1½	5 14 3
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 9/16	—	5 12 2
Edison Swan, fully paid ..	—	—	2½	— ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	— ⅛	6 0 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19½	—	5 2 7
Henley	25	25	20	+2½	6 5 0
do. 4½ Pref.	4½	4½	3¾xd	—	5 12 2
India-Rubber	10	10	15	+ ¼	*6 13 4
Telegraph Con.	20	20	43	—	*5 11 9

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month. £	£	No. of weeks.	Total to date. £	£	Route miles open.	Inc.
Bristol	..	..	..	..	..	..	..	..
Cork		..	..		..		..	..
Dublin	Feb. 22	29,[illegible]59	+ 6,493	8	54,509	+ 9,731	..	..
Hastings	„ 25	3,656	+ 664	8	7,473	+ 569	..	..
Lancashire United	„ 27	10,408	+3,706	9	20,747	+ 6,481	..	..
Llandudno-Col. Bay	„ 22	980	+ 318	12	2,7[illegible]4	+ 640	..	..
Anglo-Argentine ..	„ 25	213,729	+13,906	8	423,144	+ 24,972	..	..
Auckland	Oct. 26	22,30[illegible]	+ 880	17	92,118	+ 7,822	..	..
Calcutta	Feb. 23	19,182	+ 780	..	..	1,101	..	..
Kalgoorlie, W.A. ..	Oct.	2,785	..	10m	26,923	..	..	..
Madras	Feb. 15	2,470	— 82	6	7,709	+ 681	..	..
Montevideo ..	Jan.	36,016	+2,675	13	101,101	+ 7,993	..	..

SWITCHGEAR STANDARDISATION.

By CHARLES C. GARRARD, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 199).

Cut-outs.

While the standardisation of cut-outs has been carried out to a considerable extent in other countries, with us practically nothing has been done.

Many electric supply authorities issue their own specifications for house service cut-outs, necessitating special drawings, patterns, and tools. The same remarks apply to house-service cable boxes, main switches, and the like. It is perhaps too much to hope that all this can be swept away, within a reasonable time, simply by the issue of specifications by the Engineering Standards Committee. An energetic propaganda among the responsible parties will be necessary to secure the desired results. These could best be obtained probably if supply engineers could be induced to take the matter up themselves with the object of securing uniformity as regards house-service fittings. By these means very valuable information could be made available which would guide the Engineering Standards Committee in its preparation of the final specifications.

In this connection it is interesting to note that the Municipal Tramway Association has appointed recently a committee to deal with the standardisation of overhead construction, which proposes to draw up specifications for every overhead fitting used in tramway work, including trolley wires and wheels. The Committee intends collaborating with the American Tramways Standardisation Department and with the British Engineering Standards Committee, and should provide a working model for the arrangement now suggested for dealing with electric supply fittings.

The enclosed cut-out standardised by the American National Electric Code is completely standardised as regards dimensions, and its use is practically obligatory in America. The manufacture of "N.E.C." enclosed cut-outs has consequently become a very important industry, engaging the attention of a number of specialist firms. The general use of open and protected type cut-outs, as in this country, has been impossible in America. As, in spite of this, the fire hazard in this connection is not any greater with us than in the States, it cannot be said that the universal use of the relatively expensive enclosed type is justified. Nevertheless, there is a considerable field for enclosed cut-outs to meet severe conditions, and a British Standard for such should be set up as well as for the protected type. Open-type cut-outs should be prohibited.

The short-circuit test called for in the "N.E.C." enclosed cut-out is one of 10,000 amperes, independently of the size of the fuse. While this is a comparatively light test for a large cut-out (say, 400 amperes working current), it is a severe one for small currents (10 or 30 amperes), and one which many protected-type cut-outs will not pass. For very many purposes, however, such a severe test is quite unnecessary.

It has been generally agreed that the severity of a short-circuit test to which a cut-out is subjected may be measured by the value of the short-circuit current which would flow if the fuse were replaced by a heavy copper connection having no appreciable resistance, the electromotive force of the supply remaining constant.

The various methods adopted by the standardising authorities of the different countries for determining the rating (as regards short-circuit capacity) all go on the same lines, that is to say, the cut-out is short-circuited across a sufficiently large source of power with the short-circuit current limited to certain values.

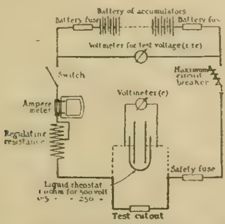

Fig. 8.—Standard Cut-out Test of the Swiss Electro-technical Society.

Fig. 8 illustrates the test specified by the Association Suisse des Electriciens for enclosed cut-outs up to 60 amperes working current. The battery must have a voltage measured on open circuit at least 10 per cent. larger than the voltage of the cut-out being tested. The liquid rheostat of the value stated in the figure is first connected across the terminals of the cut-out (the latter not being in circuit), and the adjustable resistance arranged so that for a 250-volt cut-out a current of 500 amperes flows. It will be seen that this allows for a 10 per cent. drop at 500 amperes across the adjustable resistance, which corresponds to a short-circuit current of 5,000 amperes. The test fuse is then connected instead of the liquid rheostat, and must rupture the circuit without an explosion or sustaining the arc.

In Table II the various figures for the different countries are tabulated.

TABLE II.—Values of Short-Circuit Current specified by various National Rules for the Testing of Cut-outs.

Working current of cut-out.	Swiss.	German.	American (N.E.C.)	Schwart and James.
Amps.	Amps.	Amps.	Amps.	Amps.
10	5.000	4,000	10.000	990
30	5,000	6,000	10,000	1,980
60	5,000	12.000	10.000	3.960
100	—	20,000	10,000	6.600

It is necessary to specify the minimum of plant that shall be used. It is suggested that 100 kw. would be sufficient for ordinary duty cut-outs, and 500 kw. for heavy duty ones. More may be necessary in order to reach the short-circuit capacity when testing the larger sizes of cut-outs.

The time taken to blow a fuse depends upon its size and the degree of overload.

Schwartz and James suggested the following definition of "normal fusing current":—

"The minimum current required to fuse the wire in such a time interval as shall be necessary for the wire to have attained its maximum steady temperature."

This is practically the same definition as has been adopted by the National Electric Code.

If a definite and fixed time element were specified it would be necessary to specify a different value of time element for each diameter of fuse wire; secondly, it would be necessary to have different values of time element for open, protected, and enclosed cut-outs, and likewise different time elements for each fuse metal.

A current just below the normal fusing current could flow indefinitely, and whether the conductor will reach a dangerous temperature will depend upon its heat dissipating capacity.

The Institution Wiring Rule No. 98 *b* requires that fuses "must be so proportioned to the current to be carried that no conductor protected by them can be raised in temperature above that specified in Rule 44."

It would be very desirable if directions could be issued to guide the user in applying this rule. As it stands, the requirement simply begs the question. At any rate, to specify the time element of a cut-out does not serve any useful purpose, and it is suggested it should not be done.

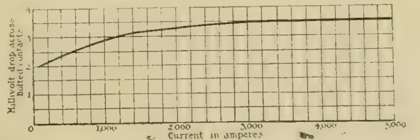

Fig. 9.—Millivolt Drop Across Bolted Contacts.

For the construction of starters and regulators the copper-nickel alloys have stood the test of time, and should be standardised. The use of iron wire should be prohibited, as well as any alloy containing zinc. At the present moment many wire manufacturers make the same wire, but call it by different trade names. This leads to confusion, and is very undesirable. It should be quite possible now to fix upon a series of standard copper-nickel alloys, naming them, for example, British Standard Copper-Nickel Nos. 1, 2, 3, &c., which should cover all usual requirements. Tables of their resistances, temperature coefficients, &c., should be issued.

The most urgent matter in connection with motor starters requiring standardisation is that of rating. Closely connected, of course, with the standardisation of rating is the question of the performance of the device under standard test conditions.

A specification of temperature rise and freedom from permanent injury to the device should be laid down.

Diversity exists at present among the different manufacturers as regards their horse-power minute ratings of liquid starters and controllers. This would be obviated in future if a standard rating could be fixed. This is only a matter of definition, and could be settled immediately if attention were given to the matter by the competent authority.

It would be a great advantage if the cross-sections of strips to be used for making the connections on switchboards were standardised. Hard-drawn copper is sometimes specified for these. Hard-drawn copper, according to E.S.C. Report No. 7, has a specific resistance 2 per cent. higher than annealed high-conductivity copper. Its use, moreover, is wasteful, as it has to be purchased in straight, comparatively short, lengths. Thus it has to be cut to waste much more than copper purchased in long rolls. Moreover, built-up hard-drawn bus-bars must contain many more joints which are expensive to make, and also the cause of ohmic loss. In view of these facts it would be desirable to standardise on the basis of annealed copper. All strips, except the smallest, should, as far as possible, be of a uniform thickness (say ⅜ in.), but of varying widths. The use of such thin strips permits of large bars being built up with maximum ventilation; moreover, they are very much easier to handle than thicker strips.

The measurement of the temperature-rise of connections should be by thermometer. Connections in the immediate neighbourhood of instrument shunts should be allowed to run hotter than the normal, as such shunts dissipate their heat to a great extent through the connections. Temperature measurements should therefore not be required to be made within 1 ft. or 1½ ft. of the shunts measured lineally along the conductor. Reasonable values would be up to 500 amperes, not to exceed 20 deg. C. rise; 500 up to 1,500 amperes, 30 deg. C.; and 1,500 amperes and above, 40 deg. C. A standard of millivolt drop for bolted and riveted connections would be very desirable, and as a contribution to fixing this the curve in fig. 9 is given showing results obtainable by reasonably good workmanship.

The only British standards (apart from some minor requirements in the Institution Wiring Rules) as regards switchboard construction which have been as yet established are contained in the official regulations issued by the Home Office and Board of Trade. These are, however, concerned primarily with the safety of the workmen and of the public, and while their constructional requirements are excellent in themselves, they are not appropriate means for setting up such standards. These should form the subject of special specifications to be issued by the Standards Committee. Among the requirements to be covered by such specifications may be enumerated the following:—

Clearances, general arrangement of apparatus and connections, prohibition of the use of inflammable material, passage ways, gates, shields, &c.

From the manufacturing point of view it would also be an excellent thing if the dimensions of slabs used in switchboard construction could be standardised. This has already been done by individual manufacturers, and, if all could be brought into line, considerable economy would be effected.

As regards high-tension boards, a code of principles should be set up which would guide central-station engineers and manufacturers in selecting the type of board most suitable for the particular service required. This matter is of particular importance in view of proposals for linking-up and bulk supplies, which are likely to be considerably extended in the future. Such linking-up is difficult and costly of realisation when the stations to be connected are equipped with differing forms of switchgear.

One of the most beneficial principles of high-tension switchgear construction is the cellular principle originally enunciated by Dr. Ferranti. In the author's opinion all high-tension boards should be based upon this fundamental idea. Modern experience has shown that the cells containing the oil switches should be practically gas-tight, and the effect of arcs which have been set up as the result of accidents has demonstrated the necessity of very substantial construction of the dividing walls and partitions.

The Commission on High-tension Apparatus set up by the Swiss Elektrotechnischer Verein reported that it had been found necessary to leave openings in the oil-switch tanks to prevent their bursting when "internal explosions take place."

It is very much better to make the switch tank sufficiently strong to withstand, in conjunction with a sufficient air cushion above the oil, any pressure which may be set up due to operating conditions. Such a construction does not offer any insurmountable difficulty. If a vent to relieve pressure inside the oil switch is provided, this should communicate through a pipe with the open air or a place where the expelled fumes are harmless. The provision, however, of a drain pipe would seem to be a desirable precaution against accidents.

The horn gap, forming as it does a necessary constituent of very many forms of lightning arrester, should be standardised as regards its shape and jump-over voltage. The latter depends partly upon the diameter of the rod used in the construction of the horns, and this must therefore be specified. As regards material, both galvanised iron and copper yield good results.

Great diversity exists in present-day practice as regards the size of choking coils used for the protection of machinery against the entrance of dangerous currents. It should be possible, however, to lay down standards (expressed in millihenries) of inductance which will afford reasonable protection in the various cases. A general formula with the necessary curves for use under these conditions should not be very difficult to obtain, and their general use would prevent disputes arising.

The precise shape and arrangement of the coil should for the present be left to the different manufacturers. The minimum clear air space between the turns of the coil should, however, be fixed.

It is probable that most new transmission lines of any considerable magnitude in the near future will be protected by the aluminium electrolytic arrester.

A very considerable amount of development work in connection with the aluminium arrester has been carried out in the private research laboratories of manufacturing firms. While a good deal of the results of this work has been, with commendable broad-mindedness, published in the technical Press, naturally much is withheld and regarded as a trade secret. In view of the importance of the matter from the point of view of the future of the British electric supply industry and of the export trade, this is unsatisfactory, as the constants of such a vital piece of apparatus should be common property, just as are, for example, the insulating properties of the commonly used dielectrics.

The question of the establishment of a national high-tension research and standardising laboratory has been touched upon. Such a question as the lightning-arrester problem could be dealt with by such an institution. In this and analogous electrical engineering developments we are not taking the leading place that we should occupy, and if this Institution could, in co-operation with the industry, take steps to alter this it would earn the gratitude of very many of its members.

Discussion at Birmingham.

Mr. F. Forest said it was difficult to see how the standardisation of switchgear arrangements could be introduced with advantage at the present time, and especially the standardisation of complete cellular construction in connection with E.H.T. switchgear. There was, in fact, some likelihood that the E.H.T. switchgear for large bulk supply generating stations in the future would consist of a simple arrangement of duplicate lead-covered cable bus-bars and connections, very strongly clamped and supported, with oil-immersed isolating switches, and with only the oil switch totally enclosed in a separate compartment. If the author's proposals were confined to details of switchgear apparatus only, they would receive almost universal support.

Mr. R. L. Goold said that the real obstacle to complete standardisation was the existence of competition—the desire of one manufacturer to excel another. This was an axiom of healthy progress in refinement of construction and evolution of design. Standardisation was eminently desirable in matters such as the back connection studs and nuts, the length of break, the area of the contact surfaces, and other matters attending the fundamental switch function of conducting and breaking an electric current. As to a standardisation of the general style of construction which the author proposed, he thought this was a controversial subject. In the production of switchgear it was difficult to see how the standard switch would be obtained by co-operative action on the part of designers and manufacturers.

Mr. A. Krouse said that standardisation must not mean the fettering of progress; research and experiment must be excluded from the domain of standardised products, but both these must be carried out systematically with a view to ultimate standardisation. As an example of the advantage to be gained by standardisation, he referred to slate bases. These were worked by a dozen different firms, each of which made for most other trades in which slates were used, consequently, each firm had a maximum variety of requirements, with resulting inefficiency and want of precision.

Mr. G. Rogers agreed that standardisation of switchgear was urgently required; he knew of scarcely any branch of switchgear the parts of which were standard, and engineers were constantly up against trouble and needless delay in emergency through the lack of interchangeability of switchgear. The author suggested the standardisation of millivolt drop for switch contacts. The speaker was of the opinion that in each case the standard should be simply the current density of the surface contacts. There would be two standards; one for flat surfaces, and one for laminated brush contacts. In both cases the surfaces should be properly ground in. He agreed with the author that the ordinary Whitworth threads for large diameter studs were too coarse—the finer the thread, the better the contacts, and the more sensitive the action of the nuts in drawing together a number of flat surfaces, particularly when tin-foil was used between contact surfaces. Also, all nut dimensions should be standardised, so that the spanners on the job would fit every nut on the switchboard. He did not think that it was necessary to standardise the sizes of copper used in the building up of bus-bars. A much better and easier job could be made of heavy bus-bars with copper thicker than the author suggested. The details of the large number of indicating and integrating meters used on switchboards required careful consideration. Holding-down screws, and size and position of terminals, should be standardised in order that the instruments should be interchangeable.

Mr. R. G. Jakeman said, referring to Table I, it would be seen that the first four on the list were practically the same as the standard Whitworth gas thread; it would be advisable to adopt this rather than produce another standard. It was practically impossible to insulate the first coils of large induction motors sufficiently to prevent breakdown, and it was certainly the best practice to provide an external choking-coil. There was no reason why it should not remain permanently in circuit.

Mr. R. Orsettich said the discussion had shown that the views regarding standardisation were very divergent, due to the fact that the paper did not distinguish between internal and external standardisation. By internal standardisation he meant that affecting the manufacture in the works, whereas by external he meant the rules and arrangements which were made with regard to the user of the apparatus. The internal standardisation, apart from its importance to the manufacturer, affected the industry as a whole in so far as it was the basis for the production of parts or materials by firms and specialists, for instance, china insulators, copper strips, screws, carbons, &c. The external standardisation, on the other hand, greatly affected the operation, replacements, and repairs of plant. In fixing rules of this kind they must not limit future developments, but, rather, they must make room for expansion. The rules must, therefore, be mainly concerned with the drawing-up of a definite specification to enable buyers to state comprehensively all their requirements, and also to identify and compare the apparatus offered. Furthermore, they must state clearly and uniformly the tests with which the apparatus would have to comply, and the minimum conditions of acceptance. Very important amongst these were the endurance tests which had been brought forward by several standardising committees with a view of fixing the minimum time during which any apparatus had to operate satisfactorily before requiring attention or repair.

Mr. H. W. Dipple said that any standardisation of knife switches should specify for the grinding and finishing of the contact surfaces, so that the whole of the available area was used. In large C.B. telephone exchanges it was important that the resistance of the main circuits between the batteries and the point of distribution to the individual circuits should be kept as low as possible in order to avoid cross-talk; the Post Office usually specified the contact area to be not less than 1 sq. in. per 200 amperes, and the conducting parts to be not less than 1 sq. in. per 500 amperes. He had seen cases on new installations where the switches as received from the manufacturers were in such a state of adjustment that only about one-third of the available area of contact was used, consequently the switches had to be adjusted on the site. The same remarks applied also to cut-outs of the clip type with porcelain or fibre handles. He had seen such fuses received from the makers with only about one-quarter of the available contact area actually in use.

Dr. C. C. Garrard (in reply) said that several speakers appeared to think that the effect of standardisation would be to hinder progress. In his opinion the direct opposite was the case, and Mr. Krouse hit the nail on the head when he said that standardisation and research must go hand in hand. Standardisation provided a jumping-off place for new advances and improvements. It was really surprising that nowadays it should be necessary to argue for the principle of standardisation in general. Everybody who had had experience in a factory of any pretensions at all knew that works standardisation was absolutely necessary, and the national standardisation advocated in the paper only carried us a step further. He emphasised the urgent necessity of the standardisation of brass, and suggested that a committee should be set up in Birmingham working under a delegated authority from the Engineering Standards Committee to deal with this question.

THE YEAR'S PROGRESS IN THE U.S.A.

In the course of an article on the progress made in 1917, *Power* refers to the trend toward higher steam pressures. With proper selection of available equipment and close attention to air leakage it is now possible to maintain a vacuum 97 per cent. perfect, leaving little to gain. At the upper end of the thermal cycle the opportunity for improvement is greater. With present materials and designs a maximum initial temperature of 700 deg. is considered the practical limit. Made up in the proper proportions by pressure and superheat, there is a possible 10 to 12 per cent. gain in economy over present results. Increase of friction with the density of the steam, the greater expansion and contraction and other practical difficulties detract from the above theoretical estimate, but even a portion of the gain mentioned is worth striving for. Turbine builders see no insurmountable difficulties in perfecting their machines for the higher pressures. However, radical changes in boiler and valve design will be necessary. The pressure limit for the standard boiler has been placed at 350 lb., whereas 500 to 600 lb. is anticipated. Experimental work to develop boilers for these pressures is now in progress. At the present time pressures up to 250 lb. are common, and during the last year a number of installations were made or planned in which the pressures will be higher.

At Joliet, the Public Service Co. of Northern Illinois has cross-drum boilers designed for 350 lb. pressure and 225 deg. of superheat. This is the highest pressure used in a central-station plant in the U.S.A., and it is generally conceded that it is about the limit for boilers of the present standard design. In the same plant an innovation is the use of a horizontal all-steel individual economiser placed above and integral with the boiler, the whole being enclosed by a steel casing. Although careful tests have not been made as yet, the boilers have been in operation long enough to indicate that they will develop exceptionally high capacities and that the efficiency may exceed 80 per cent.

The new steam station of the Buffalo General Electric Co. is designed for 275 lb. pressure and 275 deg. of superheat, giving a total steam temperature of 689 deg. The station was planned for a capacity of 200,000 kw., but the initial installation was 60,000 kw. in three units. The boilers are of the cross-drum type, having 11,400 sq. ft. of steam-making surface each. They are fired at both ends by two 15-retort underfeed stokers. This duplex stoker setting, measuring at the grate level nearly 24 ft. wide by 17½ ft. deep, is the largest ever built, and the ratio of grate area to heating surface, 1 to 27.3, is probably the most liberal employed in power-plant practice. At normal rating a trifle less than two tons of coal per hour is fed to each boiler. The stokers are capable of supplying 15 tons per boiler per hour, and when feeding 10½ tons per hour per boiler, which is well within easy operation, the rate of combustion is about 50 lb. per sq. ft. of grate, and the evaporation per sq. ft. of heating surface is 14.4 lb. When this is compared to 3 lb., which is considered a fair figure for normal operation, it is evident the plant has been designed to carry overloads that would have been considered impossible a few years ago. To avoid difficulties with scale the make-up water is distilled.

Last year a list was given of large turbines on order. Some of these were the 50,000-k.v.a. turbo-generator for Connors Creek, the 60,000-kw. three-cylinder unit for the Interborough, a 45,000-kw. turbine for the Narragansett Electric Lighting Co., of Providence, and five 30,000- and 35,000-kw. machines for the Commonwealth-Edison Co. To this list may be added a 45,000-kw. two-cylinder compound unit and a 70,000-kw. three-cylinder machine, the largest ever made, for the Duquesne Light Co., of Pittsburgh. Some of these machines have been installed, and the others are still in the making.

In the impulse turbine there is a noticeable tendency toward symmetrical cone-shaped construction, the elimination of angles, and the production of a straight path for the steam. The early stages are becoming smaller in diameter and fewer to minimise the friction and leakage, which increase with the density and pressure of the steam, and better metals are being employed so that a high velocity of the blading may be maintained. The numerous control valves regulating the quantity of steam to the turbine have been replaced by a single throttle valve that for loads below normal lowers the pressure. This reduces the density of the steam and lessens the aforementioned losses without diminishing the heat content per pound. At the low end the stages are increasing in diameter to reduce the leaving loss to a minimum. In many of the late machines the length from the first to the last stage is less than the short diameter of the exhaust opening.

In the smaller units the turbine is rapidly replacing the reciprocating engine, even invading the small office-building plant. It requires comparatively small space and little attendance. There is no oil in the exhaust steam, and reduction gearing permits economical speeds for both the prime mover and the driven machine. The small turbine for auxiliary drive has been perfected and its economy improved. To make a combined pump or blower unit with less cost, weight, and dimensions, a one-bearing turbine has been brought forth. It is incomplete in itself, but becomes an integral part of the over-all equipment.

To take advantage of the low steam rates of the large turbines, the trend toward electrically-driven auxiliaries has continued, steam drives, principally turbines, being maintained in lesser number to ensure continuity of service and to maintain a proper heat balance.

Manufacturers report orders for geared units as opposed to the direct-connected turbine in the ratio of three to one. In operation the gears are standing up well, and have been perfected to such a point that they make little noise. Large geared units for excitation are being built up to 1,000 kw. In these designs the turbine may operate at its most economical speed, and the generator at the low speed necessary to ensure perfect commutation.

Surface condensers are naturally following the turbine and getting larger each year. Up to date 70,000 sq. ft. of active tube surface in a single shell is the largest. Condensing equipments for the 60,000- to 70,000-kw. turbines for the Interborough and Duquesne Light Co. plants are to contain 100,000 sq. ft. of surface, but it is to be disposed in four shells. Among large jet condensers the installation at Providence serving a 45,000-kw. turbine still holds the record.

A boiler unit commensurate in size with the larger turbines has been developed. It is known as the Stevens-Pratt boiler, and is made up in four sections, each being a complete Babcock & Wilcox cross-drum boiler in itself, with its own superheater, economiser, and forced- and induced-draught fans. There are two sections on either side, the boilers being placed back to back. One stack serves the unit, and the coal- and ash-handling equipment is common to the two sections on the same side of the unit. If desired, any one or more of the sections may be operated independently. The sections are made in sizes ranging from 5,000 to 14,500 sq. ft. of heating surface. Four of the largest sections operating at 400 per cent. of rating will carry 58,000 kw. The unit occupies 7,632 sq. ft. of floor space. It avoids an elaborate boiler room building, as, with the exception of the coal bunkers, the unit is complete in itself.

During the year 25-cycle rotary converters up to 6,825-kw. capacity have been put in operation, and 60-cycle machines up to 5,500 kw. in size have been installed. These machines are the largest of either type that have so far been built.

The most interesting transformer unit of the year is probably the 44,000-volt to 6,000-volt, 8,000 k.v.a. oil-insulated self-cooled unit, six of which were built for the Carnegie Steel Co. The radiators are constructed of a number of vertical flattened tubes welded into headers, which are flanged and bolted to the tank. The 24 radiators on each tank give an effective cooling surface of approximately 1,000,000 sq. in. Oil-insulated water-cooled units of over three times the foregoing capacity are under construction or being installed.

The Pacific Light & Power Co. has installed in its Eagle Rock sub-station at the end of a transmission line 241 miles long, a 15,000-k.v.a. synchronous condenser. This is used to maintain constant voltage at the receiving end of this long transmission line, which is operated at 135,000 volts with grounded neutral at the power-house end. Before the condenser was installed, the no-load voltage at the receiving end was 211,000 volts. With the condenser in service the voltage at the receiving end of the transmission line is held practically constant under all conditions of load.

In the steel industry the application of electricity has continued to make rapid advances. There is in use at the present time approximately 690,000 h.p. on main-roll drives in the United States, an increase of 400 per cent. during the last five years. These drives require very large motors. A reversing blooming-mill unit is one of the largest direct-current single-unit motors that has so far been built. It has a momentary rating of 10,000 h.p. at 40 r.p.m. The machine is fully compensated, and is shunt-wound. In spite of its great size, it can be accelerated at the rate of 50 revolutions per second. The motor is supplied with power from a flywheel motor-generator set, consisting of a 2,000-kw., 500-volt generator, driven by a 2,200-volt, 2,000-h.p. induction motor. The flywheel weighs 100,000 lb.

The vast increase in the use of electrical furnaces is evidenced by the fact that in the U.S.A., January 1st, 1916, there were 36 furnaces in use, having a capacity of 191 net tons, and requiring 90,000 k.v.a. At the present time the capacity has increased to approximately 1,000 net tons, requiring about 230,000 k.v.a.

A 250,000-kw. totalising graphic meter built for the Keokuk plant of the Mississippi River Power Co. is the largest meter ever constructed. The instrument will give a graphic record of the output of the 30 3-phase, 7,500-kw. generators to be installed ultimately in this plant. To accomplish this, 30 polyphase-meter elements, each made up of two single-phase units, are used. The induction type of meter element is employed. The moving element consists of six aluminium vanes, all supported on a single shaft. All connections are carried to the top of the instrument to a circular terminal board having 240 binding posts. The chart is 12½ in. wide, and is printed in 12-hour sections, and feeds at the rate of 3 in. per hour.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

2,860. "Magnetic compasses." H. O Merriman. February 18th.

2,863. "Signalling lamps." E. W. Lovely. February 18th.

2,877. "Electrolytic gas process." D. Macdonald & R. F. Macdonald. February 19th.

2,878. "Carbonisation and distillation of coal, &c., by electricity." L Moorhouse & C. W. Simpson. February 19th.

2,886. "Method of producing electricity and mechanical power by permanent magnets." D. Suchostawer. February 19th.

2,912. "Electrically-operated friction clutches." M. Walker. February 19th.

2,953. "Electric gas-lighters." J. W. Mackenzie (Safety Gas Lighter Corporation, U.S.A.). February 19th.

2,970. "Electric steel manufacture." V. Stobie. February 20th.

2,985. "Dynamo electric machines." D. Swift & P. Churchill. February 20th.

3,005. "Morse-code recorder." E. Fox. February 20th.

3,008. "Trolley heads for electric traction." W. Pickersgill & J. H. Gill. February 20th.

3,013. "Enclosed electric bells." British Agencies, Ltd., & J. B. Eder. February 20th.

3,014. "Mine, &c., electric bells." British Agencies, Ltd., & J. B. Eder. February 20th.

3,016. "Travelling apparatus controlled by electric waves for deposit of mines, for attack, for supply of munitions, &c." G. de Yrarrazaval. February 20th.

3,022. "Electric resistances." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 20th.

3,023. "Electrically-controlled window raising and lowering mechanism." F. W. Howorth (Perfect Window Regulator Co., U.S.A.). February 20th.

3,056. "Dynamo-electric machinery." F. Creedy. February 20th.

3,059. "Electromagnetic apparatus for detection of large masses of iron or steel." A. H. Booth. February 21st.

3,070. "Electric resistance furnaces, and heaters and resistances, &c." F. Rogers. February 21st.

3,105. "Methods of manufacturing cylindrical magnet frames, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 21st.

3,106. "Electric relays." E. Fawssett & H. Parry. February 21st.

3,107. "Rotary electric switches." T. Ammann. February 21st. (Germany, February 21st, 1917.)

3,149. "Audion or lamp relay or amplifying apparatus." M. Latour. February 21st. (France, April 15th, 1916.)

3,150. "Device for detecting demagnetisation." W. A. Clark, H. G. Longford, W. W. Longford & Sphinx Manufacturing Co. February 22nd.

3,185. "Electromagnets." Soc. Anon. des Etablissements L. Bleriot. February 22nd. (France, November 7th, 1917.)

3,186. "Voltage-controlling mechanism for electric installations." Soc. Anon. des Etablissements L. Bleriot. February 22nd. (France, November 8th, 1917.)

3,188. "Controlling mechanism for use in electrical installations." Soc. Anon. des Etablissements L. Bleriot. February 22nd. (France, November 7th, 1917.)

3,195/3,196. "Magneto-electric machines." British Thomson-Houston Co. and H. K. Trenchmann. February 22nd.

3,213. "Electric heating apparatus." Naamlooze Vennootschap. Fabriek van Instrumenten en Electrische Apparaten Inventum. February 22nd. (Holland, February 23rd, 1917.)

3,237. "Electric controllers of the barrel or drum type." W. G. Pipkin and Veritys, Ltd. February 23rd.

3,244. "Means for detecting small electric currents." J. S. E. Townsend. February 23rd.

3,267. "Cord connections." Naamlooze Vennootschap Fabriek van Instrumenten en Electrische Apparaten Inventum. February 22nd. (Holland, February 23rd, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,366. Electric Accumulators. H. Leitner & W. H. Exley. October 27th, 1916. (112,956.)

18,672. Apparatus for Transforming, and especially for Rectifying, Alternating or Polyphase Currents. J. F. G. P. Hartmann. December 30th, 1915. (102,977.)

1917.

1,501. Means and Apparatus for Storing and Correcting Defective Telegraphic Signals Preparatory to Transmission. Eastern Telegraph Co. and J. H. Dunbar. January 30th, 1917. (112,978.)

1,544. Dynamo-electric Machines. Soc. Anon. Pour l'Eclairage Electrique des Vehicules. February 4th, 1916. (104,172.)

1,641. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 1st, 1917. (112,983.)

1,653. Electric Transmission of Signals. E. A. Laidlaw. February 1st, 1917. (112,985.)

1,713. Electrical Measuring Instruments. J. H. Care. February 2nd, 1917. (112,990.)

1,851. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 6th, 1917. (112,996.)

1,953. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 8th, 1917. (113,001.)

2,133. Device for Supporting the Shades or Reflectors upon Incandescent Lampholders and for Locking the Lamp to its Holder. W. Waller. February 13th, 1917. (113,007.)

3,363. Controlling Device for Electrically- or other Power-driven Air Compressors for Raising Water. P. Frank & Kynoch, Ltd. March 7th, 1917. (113,022.)

5,451. Protective Devices for Dynamo-electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 18th, 1917. (113,037.)

7,702. Dynamo-electric Machines. Soc. de Paris et du Rhone. May 26th, 1916. (107,010.)

8,631. Magnetic Pulleys and Belting. P. L. Weston. January 8th, 1917. (112,612.)

10,709. Prismatic Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) July 25th, 1917. (113,063.)

14,738. Portable Electric Transformers. Johnson & Phillips, and W. C. Kennett. October 11th, 1917. (113,077.)

Electrical Developments in Austria.—The *Board of Trade Journal*, quoting from the *Wiener Zeitung. Wiener Abendpost*, says:—"In introducing in the Reichsrat the Austrian Government's Bill for the promotion of electrical development, the Minister of Public Works emphasised the backwardness of Austria in regard to electricity. Estimates of the available water-power, he said, varied between 1,700,000 and 5,000,000 h.p. If 4,000,000 h.p. could be used, the saving in coal would amount to 22,500,000 tons per year, or about 50 per cent. of the normal consumption: Austria could then export coal to Germany, instead of having to import it from that country. Among special features of the Bill may be noticed the provision that the State will participate in the profits of undertakings to which any State privileges or concessions have been granted, when the profits exceed 6 per cent., and the provision that the State will have the right to acquire undertakings after 25 years, and at the end of every subsequent period of five years."

Power Plant Farthest North.—A 45-kw. hydro-electric plant for light and power in the town of Chitina, Alaska, has just been put into operation. It was built by the owners, O. W. and M. S. Nelson, has been under construction for two years, and cost $22,000, making it probably the most costly plant per kilowatt in the world. One of its distinctive features is that it is the farthest north of any year-round hydro-electric plant on the continent. The water-power is drawn from a three-acre lake situated 100 ft. above the Copper River and separated from it by a ridge. By driving a 1,400-ft. tunnel through this ridge, the water from the lake is carried over to the Copper River side, where it is dropped down 100 ft. through 270 ft. of 16-in. steel pipe. The tunnel was driven through 900 ft. of frozen earth and loose rock and through 500 ft. of extremely hard solid rock. The earth and rock were thawed with steam jets.—*Journal of Electricity.*

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ECONOMICAL COOKERY.

One of the most remarkable and unlooked-for effects of the war upon domestic affairs has been the extraordinary impetus which it has given to electric cooking and heating, which have made probably more progress in this country during the past three years than in the 10 years preceding.* This applies especially to the use of large cooking installations in connection with the supply of meals on a considerable scale, as in factories, restaurants, &c., and so much practical experience with this kind of work has now been acquired that manufacturers and supply authorities are in a far better position than they were before the war to cope with the requirements of each case on lines that guarantee success. We have confidence, therefore, that in drawing their attention to a new opening for business which has recently presented itself, we shall not only serve their interests, but shall also render good service to the public.

We refer to the strong movement which is now in progress towards the establishment of "communal kitchens," for the purpose of cooking meals for the public on a large scale, thus saving an immense amount of domestic labour at a time when such labour is scarce, and ought to be dispensed with as far as possible, and at the same time securing the highest measure of economy of fuel, food, and money when all these commodities should be husbanded to the utmost. As we have indicated above, it is precisely when employed on a large scale such as is called for by these kitchens that electric cooking is at its best. The descriptions given by Mr. W. A. Gillott of large modern cooking installations in his paper before the Institution of Electrical Engineers are so fresh in the memory of our readers that we need do no more than refer to them; but we may lay stress upon certain features of importance in this connection.

As regards the running cost, Mr. Gillott's experience shows that with electricity at ¾d. a unit, and gas at 2s. per 1,000 cu. ft., the former is the cheaper; to the saving in cost must be added the saving in floor space, the perfect cleanliness and convenience of electric cooking plant, the absence of noisome fumes (which in a gas-heated plant necessitate special provision for ventilation), and the certainty of obtaining the same temperature, and, therefore, the same results in cooking time after time. Again, Mr. Gillott confirms the claim that electric cooking materially reduces the shrinkage of meat in roasting, his data showing a saving of more than 10 per cent.; at the present time of scarcity this is a most important consideration. Lastly, the service of communal kitchens is essentially a day load, and will not make any additional call upon the generating plant and mains.

We suggest, therefore, that electricity supply managers should do their utmost to induce the authorities to adopt electric cooking for these kitchens, and we would particularly address this proposal to the engineers of municipal undertakings, seeing that the kitchens are under municipal control, rendering their managers readily accessible to persuasion, and that the kitchens are often housed at the public baths, where hot water is obtainable on the most economical basis, and a supply of electricity is usually available without the necessity of laying a new service. The opportunity is one which, on every count, ought not to be missed; and we may add that prompt action is essential, for the rival agencies are already opening a campaign with the same object in view.

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* Striking instances are given in our "Notes" and "City Notes" to-day.

“ Daylight Saving ” all the Year Round.

Whatever may be thought of the principle involved in the adoption of the “ Summer-time ” system—to our mind it is unscientific and artificial to the last degree, being, in effect, a device for tricking ourselves into getting up an hour earlier—it is not denied that under war-time conditions it results in a modest economy of fuel and facilitates the cultivation of allotments, and may be accepted, therefore, as a temporary makeshift until the nation grows up and is able to dispense with make-believe. But it is obvious that what is put on at the end of the day is —or ought to be—taken off the beginning of it, and hence if the period during which the device is employed is too greatly extended, we shall merely transfer the consumption of fuel for lighting and heating from one end to the other, with advantage to no one. This, in fact, is what already happens to some extent in the spring and autumn in the case of the many workers whose calling requires them to rise very early in the morning, and the extension of the period this year to embrace the whole interval between the vernal and autumnal equinoxes will aggravate the trouble.

What, then, are we to say of the proposal put forward by Mr. Samuel Insull, president of the Commonwealth Edison Co., of Chicago, who, according to the *Electrical Review* of New York, strongly advocates a change in time *all the year round?*

Mr. Insull's achievements and position in the electrical world are such that any proposition he supports *ipso facto* demands serious consideration. The conditions obtaining in the United States as regards working hours, &c., may differ considerably from those with which we are familiar here. Mr. Insull estimates that “ daylight saving ” for five summer months (*sic*. Would that *we* could look forward to five months of summer, instead of the scraps our climate allows of) would save the electricity industry in Chicago about 15,000 tons of coal per annum, and the entire country 230,000 tons of coal; it would save the electric light consumers of the United States 7½ million dollars a year, “ this being a loss of income to the lighting companies, with coal the only off-setting saving.” All honour to Mr. Insull's altruism. But if daylight-saving were made effective throughout the year, the day power load and evening lighting load would not overlap so much as at present, thus reducing the peak, and saving capital expenditure. This appears to be the main ground upon which he bases his contention.

We may point out, however, continuing the line of argument which we have put forward above, that if this course were followed there would be a heavy lighting, heating, and cooking load in the early morning, which might overlap the traction and power load sufficiently to reproduce the evening peak in the morning hours, in which case no advantage would be realised.

There is also another aspect of the question to which attention may be directed—namely, that the peak is progressively diminishing in importance as the efficiency of lamps improves and the day-load curve fills up. Moreover, the adoption of electricity for heating and cooking is extending very rapidly, and these loads, whilst fairly heavy in the morning, have not been found to add materially to the evening peak. The shape of the load curve, in fact, is changing all the time, and it is not possible to predict it very far ahead. On the whole, we cannot see that any appreciable benefit would be derived from the policy under consideration; it seems to us that it would in the end defeat its own object, for once the change was made, the time for the whole year would be *permanently* set forward, and people would gradually work into their old ways and times regardless of the clock, which eventually would have to be set forward again. It reminds us of the kitten chasing its own tail.

* * *

The Electrical Regeneration of France.

It is certain that a very prominent part will be played by electricity in connection with the restoration and reconstruction of the regions devastated by the enemy in the North, North-East, and East of France, which constituted some of the richest industrial districts in that country prior to the war. Already the competent authorities, assisted by the interested professional organisations, have prepared a scheme relating to the measures to be adopted for restoring the economic life of the areas in question on their return to the rightful owners.

Among the urgent problems which will then arise will be that concerning the supply of power to all the establishments (textile, sugar, coal, engineering, chemical, iron and steel, paper, &c.) which will be raised from the ruins. In 1912 the steam plant in the districts ravaged by the invasion was distributed over 10,575 establishments, with an average power of 102 H.P. On the other hand, the output capacity of the distribution companies amounted to about 57,000 H.P., and the length of mains to approximately 3,100 miles. It is assumed that private steam plant, central stations, pole lines and conductors will have entirely disappeared. It would, therefore, seem that the only means of their attaining the desired object will be by the organisation in a rational manner of the production of electrical energy in large works erected on the most favourable sites, interconnected and supplying sub-stations, whence the distributors would be taken to the different localities. Before the war there were no fewer than 236 central and private stations of one kind or another for the purpose of distribution in the districts under consideration. This economic error, according to the scheme now under discussion, is to be remedied by the erection of large stations, which will render useless any small plants in the future, will reduce the transport of coal, and render the railways better able to convey materials for the rapid reconstruction of the districts concerned.

The Chambre Syndicale des Usines d'Electricité, in a report presented to the Ministry for Public Works last September, estimates that it will be advisable to lay down plant of 300,000 H.P. for the purpose in question, of which 100,000 H.P. should be ready on the cessation of hostilities. The Chambre suggests the adoption of the 3-phase system at 50 periods, with identical generating sets each of 5,000 KW. In addition, the Syndicat Professionel des Producteurs et Distributeurs d'Energie has made a study of the question of the unification of the pressures of transmission and distribution, and has set forth proposals which, in the opinion of the Syndicat, appear the best adapted to the purpose. The whole programme is now in course of execution. As, however, time will be required for the erection of the permanent stations and transmission lines, and energy will be needed at once, it is intended to construct temporary stations at first, which will be equipped with the generating sets on order, whilst at the same time recourse will be had to the surplus of energy available at the works erected by the military authorities in proximity to the front and in the reconquered districts.

ELECTRICAL DEVELOPMENTS IN ITALY.

By E. STRACHAN MORGAN.

(Continued from page 221.)

In Italy, distances of over 350 miles are already contemplated; this means that not a single town in the kingdom need be without electric service. The mportance of this can hardly be over-estimated in view of the fact that Italy is almost the only industrialised country which has no coal mines, and that, n compensation, it has more potentialities of water-power than any other country. It is estimated that the water-power theoretically available reaches the enormous amount of 40,000,000 H.P. It is most unlikely that more than a small fraction of this will ever be harnessed, even allowing for the greatly improved methods of utilisation that are sure to come in the future. The estimates, official and unofficial, of the power awaiting development vary from 2,000,000 to 6,000,000 H.P., but these are necessarily rather vague estimates. The official estimate of the Genio Civile is 4,000,000. Signor Omodeo thinks that less than 10 per cent., perhaps less than 5 per cent., of the possible available power is now utilised.

A concrete example of what has been done by judicious embankment, even on a small scale, throws some light on these possibilities, and seems to justify enthusiasm. The Brassinone, a small torrent in Emilia that barely sufficed to provide 25 H.P. to a mill, now distributes from 5,000 to 6,000 H.P. In any case, it is most unlikely that either capital or industrial leaders will be available to utilise the minimum estimate in less than several decades.

The development of this industry during the past 20 years may be considered under four aspects: (1) The increase in the number of installations; (2) the gradual disappearance of the smaller companies either by amalgamation with, or absorption by, the larger; (3) the steady decrease in the price of the KW.-hr.; (4) the riveting of the German grasp on the companies.

(1) It would hardly be possible to give the number of installations at any time with accuracy, and even if this could be done it would be but a momentary truth, as they are constantly varying; but it may be briefly stated that whereas in 1891 only 250,000 H.P. were utilised, the latest information is that rent was in 1915 paid for 1,000,000 H.P. It should be noted, however, that rent is in some cases paid in order to keep unused concessions alive; on the other hand, the industrial potentiality is always about 10 per cent. greater than the H.P. on which rent is paid. In some cases, too, rent is paid in order to prevent a rival from utilising what the concessionaire cannot at the time use.

Accepting the accuracy of these figures, it would seem that the average annual increase of power used amounted during this period to about 30,000 H.P. per annum. During these years experience taught the lesson that only enterprises on a large scale were economically sound, and this is indicated by the scale of the demands made. These were on an average:—For the years 1885-1886, 36 H.P.; 1889-1892, 130 H.P.; 1897-1898, 230 H.P.; 1909, 2,160 H.P.; and since then applications have been made for installations as large as 100,000 H.P.

In this connection, the following extract from a statement recently made by Signor Semenza (President of the Electrotechnical Association) is of interest:—

"No official statistics are available later than 1898. I have, therefore, had to depend for information as to the present position on such inquiries as I have been able to make. I have been able to get at the facts regarding 200 new plants, nearly all of which are of considerable importance. I have no details of the numerous small plants, but their total output may amount to 86,000 H.P. The total horse-power of these 200 large plants, established since 1898, amounts to about 593,000 H.P.; add to this the 123,000 H.P. existing in 1900, and the total comes to 716,000 H.P. in 1909. The small unenumerated companies produced, I assume, not less than 72,000 H.P., and thus all the installations in Italy sum up to about 890 H.P. Of the new plants about 580,000 H.P. are water-power, and 110,000 steam. The average annual increase may thus be put at about 60,000 H.P., and the capital invested during the period at about L500,000,000."

If the annual rate of increase has remained constant 1909-1917, this would imply a present horse-power of 1,200,000. It is probably rather less, as the rate of development had shown, at least till the outbreak of the war, a tendency to decrease. On the other hand, a very great impulse has been given to the use of electricity for munition factories, &c., during the war. No figures relating to these developments may be published, but when they are revealed, and when the potentialities of the power thus developed are released for peace work, it will be found that the foundations have been laid for something like an industrial revolution.

Signor Semenza enters this caveat:—"The figures given above must not be taken to represent that actually utilised, as part of the water-power is maintained as a reserve, and part of the steam power is destined to take the place of water-power during periods of drought. Making all allowances, we may reckon the power really used at 630,000 H.P. to 680,000 H.P."

This estimate, if applied to later installations, would reduce the 1,200,000 H.P. *nominal* of the present time (1917) to about 960,000 *actual*, of which, if the proportion continues to be as it was in 1909, about 770,000 H.P. would be water, and 190,000 H.P. steam.

There is a considerable difficulty in reconciling the statistics published with regard to the use of water-power. In the first place, there is some uncertainty as to what proportion of water-power is used directly, and what applied to the development of electricity. Italian statistics are always admirably neat, but do not always hold good under analysis, but we shall not be far from the mark if we assume that 88 per cent. of water-power and 53 per cent. of steam are converted into electric energy. Signor Lanino tells us that rent is paid on 1,000,000 H.P. We may assume that a great part of the 250,000 H.P. used before 1891, and therefore non-electrically, have since then been diverted to electric power, so that these figures imply that the electric horse-power is very considerably more than 750,000 H.P., probably more than 900,000 H.P. On the other hand, an equally good authority, Signor A. Omodeo, tells us that at the end of 1915 the entire share and debenture capital employed in the distribution (and production) of electric power amounted to L600,000,000 distributing 1,000,000 H.P.

Allowance must be made for the fact that though many companies state that part of their energy is produced by water-power and part by steam, they do not inform us what is the proportion of one to the other, nor how far steam power is looked on merely as a reserve.

Some important companies, such as the Societa Elettrica del Adamello, which deals with 50,000 H.P., seem from their balance-sheets to have no steam plant. On the other hand, the Societa Toscana per Imprese Elettriche, though it rents some water-power from another company, depends mainly on steam. Generally, however, one may say that the tendency is to use the steam plant merely as a reserve in case of the breakdown of water-power, and that as the water system is more and more perfected the use of steam will diminish. One reason that prevents or delays the substitution of water-power for steam is the large capital needed for the installation of hydro-electrical works. Signor G. Semenza states that this cost, including provision of water-power, transmission lines, transformers, &c., amounts to L1,430 per H.P., as against L500 per H.P. for steam.

(To be concluded.)

THE CONTROL OF LARGE AMOUNTS OF POWER.

By E. B. WEDMORE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The increasing use of electrical energy and its economical production require the use of larger generating stations and the linking together of existing plants. These extensions involve something more than the use of larger units and the adding of unit to unit. New conditions are reached. Factors which were negligible in smaller aggregations of plant become serious and limiting features.

The forces accompanying a disturbance are increased, and the total number of disturbances to which a system is subjected increases automatically with each extension; thus there are introduced new problems in the design of individual parts of the plant and in the arrangement of them.

There are no insurmountable difficulties in the design of larger machines, heavier cables, and of switchgear all able to cope with larger forces than have yet been met with, but a little consideration will show that the limiting features are to be looked for not only in the generating station, but in the distributing system. Stations and networks spread over a large area may be coupled together without necessarily seriously modifying the forces to be dealt with at any point, but a striking characteristic of developments now in prospect in the principal industrial areas is the increased concentration of large amounts of power in small areas. This inevitably follows the extended use of electricity for domestic purposes as well as for power production, and introduces new conditions not yet fully recognised.

One may double the size of a generating station with advantages in economy, and without excessive expenditure on switchgear, to take care of the conditions in the station itself; but for every machine, switch, and conductor in the main station there are large numbers of smaller machines, switches, and conductors in the distribution system, and if these also are subjected to increased forces a very heavy expenditure may be necessary to ensure satisfactory service. Not only is this true as applied to an individual town, but similar conditions may arise where a large bulk-supply scheme is devised, and a number of existing small plants are linked up to a common and larger source.

It is, therefore, very necessary to give full consideration to the new conditions introduced, and in this paper an attempt is made to anticipate the probable developments of the immediate future, and to show how the conditions arising may be dealt with.

The problem of maintaining continuity of supply and of protecting the plant is found to require for its solution the proper proportioning of the impedance of the different parts of the system.

In this country machines are already building in sizes up to 40,000 K.V.A., and larger sizes are building in the United States. Stations have been laid down for an ultimate output exceeding 200,000 K.V.A., and this figure has been approached in installations already in operation.

It is thought that in this country for some years to come the requirements will be met with stations not greatly exceeding 100,000 K.V.A., and mostly with generating units not exceeding 20,000 to 30,000-K.V.A. maximum rating.

It is not only the difficulties of water supply that tend to limit the size of stations, but in areas within which 200,000 K.V.A. can be utilised there will generally be economy in distribution by the employment of two 100,000-K.V.A. stations, it being under suitable conditions more economical to transport coal and water than to transmit electricity.

As for the size of generating units, it will be seen in what follows that the general use of units of the order of 50,000-K.V.A. output would throw excessive stresses on distribution apparatus and small plant generally unless special precautions were taken. A large unit may fail at a time when another similar unit is temporarily out of commission, pointing to the provision of two spares of the largest size, or an equivalent in smaller machines. This and the fact that such large units could not be employed economically except on large interconnected systems with a total output greatly exceeding 100,000 K.V.A., all supports the contention for the general use of machines of 20,000 to 30,000 K.V.A.

These machines, generating at about 6,000 volts, will be used mostly with transformers stepping up to 20,000 or 30,000 volts for transmission. Generally the machine and transformer bank will form one unit, all switching being carried out on the high-voltage side. There is likely to be an increasing use of overhead lines for distribution of small amounts of power over large areas, but large amounts of power will be distributed through underground cables, on account both of increased freedom from disturbance and of convenience in negotiating densely populated areas.

Means must be found to ensure maintenance of voltage at all parts of the system, and to prevent the disturbance of running machinery. Means must also be found to limit the power which can be concentrated at any point on a fault occurring, and to a figure not calling for excessive expenditure in the construction of individual pieces of apparatus.

By suitably proportioning the impedance of the different parts of the system, and by the employment of quick-acting selective protective apparatus, we can, however, both limit and localise these disturbances.

On a large plant we can to a considerable extent regain the easier conditions of small plants by dividing the system into sections and paralleling these through reactances. This will admit of the interchange of energy for purposes of economy, and at the same time limit both the interchange of energy during severe faults and the disturbances of sound sections.

The employment of reactances for interconnecting, whether between bus-bar sections in an individual station, in trunk mains between bus-bars in different stations, or in interconnectors between adjacent parts of the distributing system, has the distinctive merit that, so placed, they carry only that portion of the load which is being transferred from section to section, and thus waste a minimum of energy, and do not interfere with regulation.

Reactance may also be employed in series in any part of the system, but, so used, the reactance will have to carry the total load fed to that part.

Wherever employed, the reactance limits the disturbance in all parts of the system beyond it, and tends to isolate the disturbance from all parts nearer to the source of supply.

In discussing the use of reactance it is found convenient to rate the reactance in terms of the percentage reactive voltage-drop it will give on the full-load rating of the part of the plant with which it is associated. Just as we speak, for example, of a transformer having a reactance of 4 per cent., so we speak of a bus-bar section reactance of 10 per cent. based on the current rating of the section.

Reactance may be employed at the source, viz., in or with the generators themselves, where it need not interfere with the losses. It is anticipated that this method will be carried further than it has been hitherto. It is quite feasible to build machines economically with much larger internal reactance than has been common practice. The inherent regulation will not be so good, but the normal load fluctuations on large plants with large machines are relatively slow, so that no difficulty arises in practice.

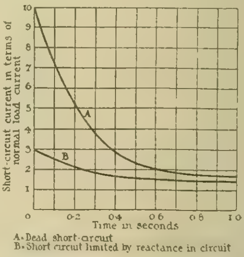

Fig. 1.—Curves showing Decrement of Short-circuit Currents in a Typical Generator.

Most generating sets will be used in conjunction with step-up transformers, the machine and transformer forming one unit. In this case, the transformer reactance will be additional to that in the machine, and will add, say, 4 per cent., but there is no reason why the transformer should not be designed to give more than this, and at a lower cost than that of employing a separate external reactance.

Generator reactance serves only to reduce the magnitude of the short-circuit currents, and does nothing towards maintaining the supply voltage in the rest of the system in the event of loss of voltage by a fault at a point. In order to maintain the supply voltage, we must employ a proper ratio of bus-bar reactance to generator reactance, and of feeder reactance to generator reactance; and as it will be found that the amount of bus-bar or feeder reactance which can be used is limited on account of interference with regulation, it follows that the generator reactance is also limited if a proper ratio is to be maintained between the two.

The rush of current which follows the development of a fault demagnetises the field and reduces the current values, as indicated in fig. 1, but at the first instant the field is sustained by eddy currents set up in the magnetic circuit, and the current is limited solely by the reactance of the windings.

The employment of artificial reactance in series with the load leads in any case to waste of energy and impaired regulation, and is, therefore, to be sanctioned only where no better solution is available.

Resistance and reactance in an individual feeder anywhere in the system affects disturbances in the following manner:—

(1) The feeder impedance helps to maintain the voltage on all parts of the system connected on the source side of the impedance.

(2) The feeder impedance assists in limiting the magnitude of the fault current at any point beyond the impedance.

(3) The voltage at all points beyond the impedance is equally disturbed.

If artificial reactance is to be employed, functions (1) and (3) call for the reactance to be located as near as possible to the point to be protected, whilst function (2) calls for the reactance to be located as near as possible to the source of supply.

Inherent reactance may be utilised, however, in such a way as to serve all three functions, as may be seen by comparing figs. 2 and 3. Fig. 2 shows power fed through eight feeders to two sub-stations and distributed through 10 outgoing feeders. In fig. 3 the same eight feeders are divided into four groups of two, and there are 16 outgoing cables of smaller section.

It is clear that in the latter diagram we have not only increased the number of sections, and thereby reduced the area affected by a given fault, but we have doubled the impedance between each sub-station and the main station, and greatly increased also the impedance in the outgoing feeders.* Thus by separation of feeders we can introduce more impedance both near the source and near the parts to be protected.

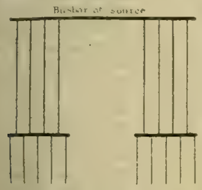

Fig. 2.

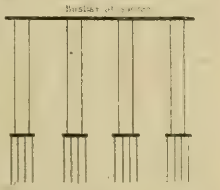

Fig. 3.

Fig. 2.—Arrangement of Feeders giving Low Inherent Impedance.

Fig. 3. Arrangement of Feeders giving High Inherent Impedance.

At the same time, if the total section of copper remains the same (neglecting the slight impairment of load factor), the losses are not increased and the regulation is unaffected.

In large systems where step-up and step-down transformers are employed, these introduce further inherent reactance, so that in practice, except where there is considerable concentration of load, the use of artificial feeder reactance should be avoidable.

Where artificial reactance is required it should be put as near as possible to the point to be protected.

The use of series reactance interferes with the regulation to an extent which may be quite serious for lighting unless the energy is transformed to continuous current. The permissible pressure drop ultimately decides the practicability of the proposition.

We conclude that inherent reactance should be utilised as far as possible, and additional artificial reactance should be used only to ensure that disturbances should be sufficiently localised and plant adequately protected against excessive stresses. These two conditions require a similar distribution of reactance in the system, but the results obtainable from the standpoint of voltage disturbance depend upon the kind of plant employed

Where the distribution is by transformer, the voltage must necessarily be disturbed to an extent visibly affecting the lighting on sections adjacent to the faulty one, but the disturbance will last only until the protective gear has isolated the fault.

In the case of induction-motor-driven sets a heavy fall of voltage is not serious so long as the fault is cleared in about two seconds or less, which lies well within the capacity of modern protective apparatus.

In the case of rotary converters and synchronous motors, we have only approximate data. A rotary converter running fully loaded will not be pulled up if the voltage falls to one-third or one-quarter of normal, but the machine is sensitive to sudden changes of phase angle. The reactance which limits the voltage drop also reduces the phase-swinging. Faults remote from the source present no difficulty, but we cannot employ sufficient reactance in outgoing feeders in the generating station to prevent the voltage being pulled down on a fault. It is likely, however, that the machines on sound circuits will not be disturbed if the voltage does not drop below 50 per cent. of normal at the source. At the first instant the drop will be much less than this, but the generators will be quickly demagnetised, and the voltage will approach the limit in less than a second.

If the generators have a short-circuit reactance of 15 per cent. and are furnished with potential regulators, it is likely that they would require a feeder reactance of 33 per cent. based on the generator rating to meet this condition. It is not possible fully to protect the rotary converters all the time, even with reactances in each outgoing feeder.

In modern practice, where the mid-point of the system is earthed, all faults to earth will be cleared without serious voltage disturbance, and the large majority of cable faults in particular are of this character. The conditions are further greatly improved by the employment of quick-acting switchgear able to clear a fault in one-fifth of a second or less.

The method of employing bus-bar reactances is intimately connected with the subject of the design and arrangement of the bus-bars themselves. It is sufficient here to recognise that there are two distinct methods of connecting up the reactances, known respectively as the "star", and "ring" methods, and illustrated in fig. 4. The star design is generally preferable after considering the operating conditions. Either system will give about equal protection, but here, again, the advantage in the extreme case lies with the star design.

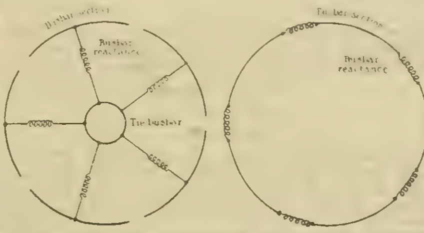

Fig. 4.—Star and Ring Designs of Bus-bars and Reactances.

It is the system which has to be sectionalised, and not the main bus-bars alone. Clearly the sectionalising of the bus-bars is of very little value if the sections are tied solidly together outside the generating station. This requires that there shall be a correspondence between the bus-bar sections and the sections of the distributing system. The ultimate plan must as far as possible be pre-arranged from the commencement so that adequate provision may be made in each section of the bus-bar for the ultimate equipment required by the corresponding section of the distributing system.

Current-limiting Effect.—In considering what results can be obtained by the use of bus-bar reactance the subject of the transfer capacity required is important, because for a given voltage difference between sections the amount of current to be transferred limits the amount of reactance which can be employed, and therefore the amount of protection obtainable by this method.

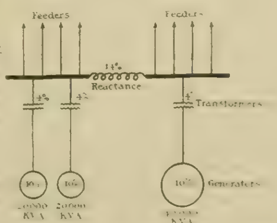

Fig. 5.—Illustration of Rating of Reactance.

In investigating the limiting effects of different combinations of reactances, the reactance associated with an individual machine, whether internal or external, or in the step-up transformer, is treated as one item, described as generator reactance and indicated by the letter A. The bus-bar reactances, however connected, are indicated by the letter B. Thus in fig. 5 A = 14 per cent., B = 14 per cent., and B/A = 1.

Fig. 6 gives a good idea of the results obtainable by the introduction of bus-bar reactances. The short-circuit current, on the assumption that no reactance is employed, is taken as unity, and the curves show how much this figure is reduced by the employment of bus-bar reactance. It will be seen, for example, that with B/A = ½ and with five bus-bar sections the short-circuit currents are more than halved. With five

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[*] From the practical standpoint, fig. 3 may require more cables by way of spares, and a larger staff of attendants, but there is an offset in that the sub-stations may be placed nearer to the demand and the average length of the feeder reduced. Moreover, cable can be reduced by interconnecting stations if appropriate protective apparatus is employed, so that, in fact, sub-division can be pushed a long way without increased cost of distribution, and with great advantage from the standpoint of continuity of service

bus-bar sections, with generator reactance of 17 per cent. and bus-bar reactance of 6 per cent., it is possible to keep the maximum value of the short-circuit K.V.A. down to three times the plant capacity, instead of 10 times the plant capacity, a common figure at the present day. That is, we build a 100,000-K.V.A. plant in which the conditions will be no more severe than in a present-day 33,000-K.V.A. plant.

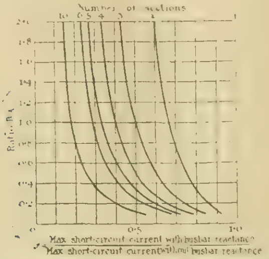

Fig. 6.—Reduction of Short-circuit Current by the Employment of Reactances in "Star."

(*To be continued.*)

Discussion.

Mr. C. P. Sparks recalled the effects observed on increasing the size of plant tenfold in the early days of the London Electric Supply Corporation, and expressed agreement with the author's remarks on the use of reactance and sectionalising for the limitation of disturbances; reactance in series he considered a mistake, as generators and transformers could be designed to give any desired reactance. Automatic regulation was indispensable to the maintenance of steady pressure. Referring to switchgear, he agreed that this country had led the way, and continued to do so, and he understood that the programme of the Sub-Committee on Coal Conservation presented no difficulty to the manufacturers.

Mr. H. Brazil referred to the heating of cables by very large currents, and doubted whether the figures given by the author were attainable in practice, owing to ohmic resistance and the reactance of bends in the cables; he had known a 10,000-volt arc some inches in length to hang on for some time without blowing a 180-ampere fuse. The destructive effects of direct-current arcs were much greater than those of alternating-current, thanks to the effect of reactance in the latter case; a fuse which was shorted close to a big battery exploded violently, parts of the device being blown to a considerable distance. He agreed that circuit-breakers were in many cases a source of trouble, and recommended Mr. Partridge's device. For high-pressure fuses in feeder circuits, silver wires in oil had done very well indeed; they had interrupted short circuits on 4,000-K.V.A. without breaking the glass cases. He preferred fuses to automatic switches.

Capt. A. M. Taylor was, in the main, in agreement with the author's conclusions. He thought, however, that the author had somewhat over-stated the case for reactances in the bus-bars, in so far, at least, as related to the potential difference between adjacent sections. On referring to Mr. Wedmore's fig. 24, it was found that, with 15 per cent. reactance in the bus, only 0.15 of the load of the bus could be transferred from adjacent sections, if the voltage rise was not to exceed 1 per cent. To transfer half of the load would require something like 3½ to 4 per cent. of potential rise, or, say, 400 volts between bus-bars on a 10,000-volt system. The sub-stations fed from different sections of the main bus-bars would therefore be at from 400 to 1,000 volts difference of potential among themselves, and interconnectors would be impracticable, which took away two or more stand-by cable connections from each sub-station. Another difficulty was with the generators. Let them consider three bus sections, each with its own generator, and that the central section, owing to irregular distribution of the load, was greatly overloaded. The two outside generators are arranged to supply current through the reactances to the central section at unity P.F. If, now, the actual load had a power factor even as high at 0.8, there would still be a 60 per cent. lagging component which had to be supplied by the central machine, and if the P.F. of the load happened to be 0.6 it would be much worse. The central generator, therefore, was "fed up" with magnetising current, and might easily be down to 0.6 P.F. This meant that its angular position was some 60 deg. different from that of the two others, and if a "short" occurred there might be considerable phase-swinging, with even risk of its falling out of step. The author said that the advantage in employing reactance in the generator was that (1) it was cheaper, (2) it did not hinder voltage control. With reference to the first, his recollection was that, in competition with another firm of certainly equal reputation, the machine with the external reactance came out the cheaper (including the reactance), and he was also informed by the builders that with still bigger machines the advantage would be increased. From the user's point of view, he still maintained the greater security of the external reactance which could, in addition, be incorporated in the main bus reactance chamber, and then served to protect the main cables (to the generator), and even the generator oil-switch itself. With regard to Mr. Wedmore's point (2), he knew of no voltage control difficulties that did not apply equally to the two cases. The speaker fully agreed with Mr. Wedmore's notes about the forces obtaining between conductors. The great value of the reactance, as against any known form of switch, was that it operated *in time to prevent the first half wave* of current from being generated. It was this first half wave that did the damage to the windings of generators, &c.

Mr. E. P. Hollis drew attention to the immensity of the forces involved in the operation of modern plant; on one occasion a 6,000-K.V.A. set broke down, and the smoke filled the engine-room, so that the switchboard could not be seen for some time; in another case a switch disappeared, and in connection with a third breakdown the explosion was heard three miles away. With the aid of reactance the short-circuit current could be limited to 10 times the normal value, but the restricted value of the short-circuit current of a modern large set was greater than the unrestricted value of the short-circuit currents of the smaller sets that we had been accustomed to. It appeared to him a barbarous method to break a short circuit on the switchgear; the current should be limited before the switch was opened.

Mr. A. Hamilton Ellis said that some years ago reactance was considered anathema in electrical supply; now one was told to install it almost *ad lib.* The first suggestion came from those who studied supply phenomena, the second from manufacturers. But did not the first suggestion still hold good? He had noticed that the majority of reasons for doing this, that, and the other in the supply business did not come from those who had to live with the job; it might be because the latter had their time fully occupied looking after the breakdowns, &c., of the plant supplied. Was the installing of reactance coils another camouflage for protecting faultily designed apparatus? In large cable systems they got maximum capacity effects, and if they went on adding inductance in the shape of reactance coils he had not the slightest doubt there would be a tendency for resonance to occur. The author did not say anything about the frequency of supply. If his figures were based on 25 cycles, then for a periodicity of 50 they would require much less artificial reactance, and probably none at all. The author said that there were no difficulties (meaning, presumably, commercial difficulty) in designing apparatus to withstand the increased strains; they why add reactance? It was said that reactance coils limited the disturbances; well, did they? He knew of a 50,000-K.V.A. station where a large machine failed, and the switch failing to clear properly, the resulting arc involved the whole switchgear, &c., shutting the station down. A similar thing happened in another station due to the failure of a current transformer, although both were protected with reactance. One could not say where an arc would finish, although one might strongly suspect where a breakdown would occur. Another point with these breakdowns was that, although both stations were equipped with the latest relays, &c., they were made inoperative due to the control wiring getting burnt up. His experience with reactance coils had not been an unmixed blessing. The most violent short-circuit he had ever had occurred only that week, due to the failure of one of these coils, and before adding apparatus which was liable to breakdown itself, increasing the cost and layout, other ways should be given very careful consideration to carry out the same thing economically. Even the author himself said that each piece of apparatus added weakened the chain, and automatically increased the risk of breakdown, so why perpetuate it? He could not see what the author hoped to gain by stepping up to high pressure for a 3-mile distribution; was he more immune from breakdown at 20,000 volts than at 6,000 volts, or could he give the cost for 6,000 volts against 20,000 volts, including the step-up and down transformer? It might be that after running these super-stations some time we should be like the Germans, having bitten off more than could be chewed.

Mr. J. S. Highfield said that he was quite certain that simplification of the apparatus was most important; perfect certainty of action and great speed were essential. He had been associated with the late Mr. Duddell in experiments on a device depending on the fact that an arc could not be maintained between certain metal contacts with less than 500 volts; a switch constructed of metal disks opening slightly in succession operated with great success on 10,000 volts. It was tested up to 600 K.V.A., but was found to be fully covered by a German patent; why was it not in use? In connection with the general extension of electricity supply, difficulties arose in tapping off for small consumers from lines at 20,000 volts; the amount of gear required was nearly as great for 50 KW. as for 200 KW. In farming districts, 20-KW. consumers would wish to be supplied from the high-pressure lines, but there was no cheap way of tapping them.

Mr. F. H. Clough said that it was quite possible to provide 20 or 30 per cent. of reactance in the generators, where it would protect not only the generators, but also the external apparatus, and maintain the continuity of supply. He recommended the use of generators with high reactance and automatic regulation of pressure; in large power stations hand regulation would be possible. In America the supply was usually converted to direct current; the power factor could therefore be maintained at unity, and reactance could be put in each feeder sufficient to absorb the whole voltage with a comparatively small current flowing. Here we distributed alternating current, introducing difficulties of regulation. Small feeders should be used, with, say, 5 per cent. reactance. If heavy feeders were employed, large reactance should be inserted, and the voltage should be controlled at the far end.

Mr. A. R. Everest said that with very large plant one must provide correspondingly large factors of safety in the small details. That was sufficiently difficult now, but would be much worse when the "super-power" plants were at work. The reactance referred to in the paper was that which existed under normal conditions, but if a machine became saturated, the reactance would disappear; the value of the reactance should be reckoned with due allowance for the actual conditions.

Mr. J. H. Sandiford said that they were all agreed that reactance would be necessary between the sections of the busbars, and suggested that the reactance coils should be standardised. He suggested porcelain in preference to concrete in the construction of the coil, and thought that the bare copper winding shown in the paper would collect dust, and lead to breakdowns between the end turns.

In reply to the discussion, Mr. Wedmore said that the proportions of reactance which he advocated now were about the same as 10 years ago; considerable departures could be made from the ideal conditions without serious results. The frequency assumed for the purpose of the paper was 50 cycles per second. Fuses could be used for small currents, but were not in competition with oil switches. Concrete was used in reactance coils for the sake of strength of construction.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Large Motor-Converter.

Our illustration, fig. 1, shows a 2,000-kw., 50-cycle, Peebles motor-converter, recently manufactured for the Sydney Municipal Council, Australia; this makes the fourth 50-cycle motor-converter unit supplied to the municipality in question, the other three machines each being of 1,000 kw. capacity.

A few years back Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, the manufacturers of these machines, supplied to the Manchester Corporation a 2,200-kw., 50-cycle motor-converter; since that time they have received an order for a 2,000-kw. motor-converter (not yet manufactured) for Johannesburg Municipality, and within the past few weeks the Manchester Corporation has placed an order with them for a still larger machine, this time of 2,400-kw. capacity. These, we are informed, are the largest 50-cycle converting units which have ever been manufactured in Great Britain.

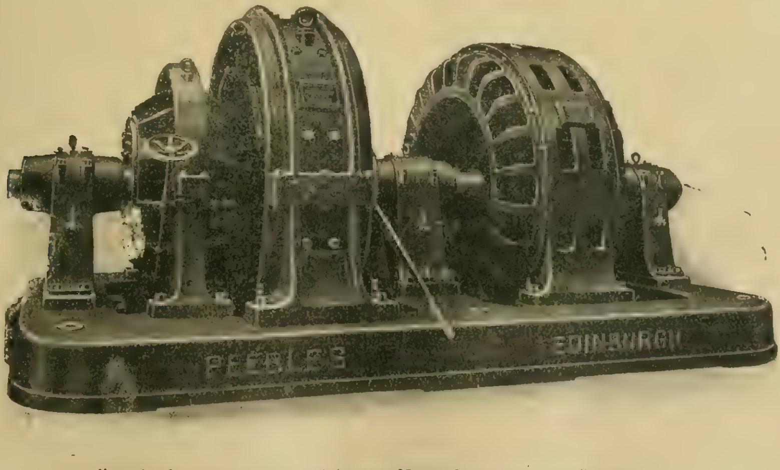

Fig. 1.—Peebles 2,000-kw. 300-r.p.m. Motor-Converter for Sydney.

The machine shown in the illustration, which runs at 300 r.p.m., is arranged with three pedestal bearings; the bedplate is split longitudinally, the facings being carefully machined and bolted together. Barring gear is provided for barring round the rotating element for cleaning or other purposes when the machine is not in operation.

The A.C. supply, which is switched direct on to the stator, is three-phase, 50 cycles, 5,000 volts, and the continuous-current end, which is shunt-wound, gives its output at 485—540 volts. Owing to the heavy continuous current, viz., 4,125 amps., the D.C. end—as will be noticed from the picture—has a double commutator, and the brush gear, which is carried from the bedplate, is of particularly substantial construction.

The machine is designed to deal continuously with an out-of-balance current equal to 25 per cent. of normal full load, *i.e.*, about 1,000 amps., and with this out-of-balance current the voltage difference between the two halves will not be more than 1 per cent. of the voltage across the outers.

This particular set, for special reasons, is started up from the D.C. end by means of a multiple-lever starter, which is short-circuited with a 4,000-amp. heavy laminated short-circuiting switch after the machine has been run up to speed. When it is installed in Sydney the starter will be mounted on the bedplate between the A.C. and D.C. machines, giving a very compact arrangement.

The A.C. rotor is provided with slip-rings and the usual short-circuiting gear, which latter is brought into use after the rotating element has commenced to revolve, but in the event of the machine ever having to be started from the A.C. end, the slip-rings and short-circuiting gear will come into operation in the usual way for A.C. starting.

The guaranteed efficiencies are 93·5 per cent. at full load, 93·25 per cent. at three-quarter load, and 92·5 per cent. at half load. The temperature rise will not exceed 70° F. after six hours' full load run, and when supplied with alternating current at 5,000 volts, and with the D.C. voltage at 505, the power factor will be unity at 90 per cent. of full load; at 540 volts and full load the power factor will be ·97 leading, while at 485 volts and full load it will be ·98 lagging.

The windings have been specially impregnated to withstand the climatic conditions obtaining in the country where the machine will operate. The magnet frame is divided horizontally, and the complete rotating element is very carefully balanced both mechanically and electrically.

Installed in the same sub-station with two of the 1,000-kw. motor-converters are two Peebles synchronous motor-booster sets. As in the case of the motor-converters, the A.C. ends of these machines are supplied with three-phase current, 50 cycles, 5,000 volts, while the D.C. ends are capable of giving 3,000 amps. at 0—187 volts.

The Latest Type of Influence Machine.

The Medical Supply Association, of 167-185, Gray's Inn Road, London, W.C. 1, has recently placed upon the market its latest type of the Gaiffe static machine, which is British made and appears to be thoroughly reliable and strong.

The mechanical construction of the machine is simple and very sound. All parts are readily accessible, and the machine can be taken to pieces quite easily, a feature being that there is no spindle, no sectors, and no glass or other enclosure. Sufficient space is left between each pair of plates to allow the hand holding a cloth to be held between, so that the plates clean themselves by rotating against the cloth. Similar machines have been running for several years in different parts of the country, and no new parts have had to be supplied beyond renewing the small leather bands and the brushes as they wore out. The whole machine is built upon a cast-iron table and run by any convenient means. The cost of driving with an electro-motor works out at about ⅛d. per hour.

The machine is not enclosed in any way, and it excites immediately on rotation. Special attention has been given to the plates, which are of vulcanite. Each plate is formed of three sheets of different qualities; this does away with the tendency to warp, and enables the outer surfaces to be made of very good quality brittle vulcanite, which in itself would not stand the high speed of rotation. The plates are nearly 22 in. in diameter, and they are run at a speed of from 900 to 1,000 revs. per minute. All the plates rotate at this speed, in opposite directions, equalling in effect similar plates if one were fixed and the other rotated at 1,800 revs. per minute. In the Gaiffe 10-plate static machine it is calculated that 1,275 square metres of vulcanite pass under the brushes per minute. The milliamperage depends on the number of the rotating plates and the speed at which they are run. A 12 plate Gaiffe machine, as shown in fig. 2, will give about 300 milliamperes, and a 20-plate machine about 500 milliamperes.

Other things being equal, the larger the diameter of the plate the longer is the spark obtainable. The 22-in. plates give sparks quite long enough for most requirements. A 12-in. plate machine running at 900 revs. per minute gives a good discharge between balls 8 to 10 in. apart. In view of the pressing need of a generator of direct current at very high pressures for electroculture and for the precipitation of dust from gases, as well as for X-ray work and cable testing, to which we drew attention in our issue of June 29th, 1917, every new development in this direction is worthy of consideration, and we believe the possibilities of the influence machine are very far from exhausted.

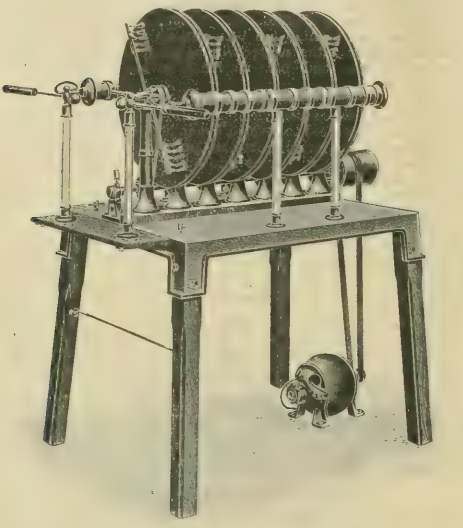

Fig. 2. The Gaiffe Influence Machine.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Organisation of Electric Supply Staffs.

There has recently appeared in your paper a suggestion of inaugurating and instituting an Association in connection with the clerical staffs of electricity supply undertakings.

May I, therefore, be permitted, through your valuable columns, to call attention to the fact that such an Association has recently been formed, and is called the Chief Commercial Officers' Association, and from this present body an Assistants' Association is about to be established. The objects of the Association are as follows:—

1. To provide means for co-operation and expression and exchange of opinions on all matters affecting the interests of the members of the Association, and of the members of any other Association with which this Association may later become affiliated.

2. To secure recognition of the Association by other kindred Associations, so that when representations are necessary to be made to electricity supply undertakings, such representation may be strengthened by combination of effort.

3. To afford advice and assistance to any individual member, and to extend protection where necessary.

4. To endeavour to promote a superannuation scheme, and to consider Bills before Parliament, particularly in so far as they affect the interests of the members of the Association.

Qualifications of Membership.—The Association shall consist of deputy managers, assistant managers, secretaries, accountants, chief clerks, and (subject to the following condition) senior commercial assistants in electricity undertakings. A senior commercial assistant will be admitted to membership only upon condition that his proposer is his senior officer in the undertaking in which he is engaged.

The Association, up to March 1st, only embraced the municipal electricity undertakings of Greater London. It was on that day decided to extend its membership to all municipal electricity undertakings in the United Kingdom, and by this means it is hoped so to increase the membership of the Association that it shall become a powerful organisation in the interests of this branch of municipal work.

The Association has already justified its existence by securing equitable treatment, and obtaining for some of its members the awards granted by Sir George Askwith on behalf of the Committee on Production.

Finally, may I say the tactics of the Association are not of a militant nature, but it is hoped that it will always achieve its ends by courteous representation and negotiation.

On behalf of the Association, I shall be glad to give any information that may be desired.

N. A. Chesterfield,

Hon. Secretary, Chief Commercial Officers' Association (Electricity Supply Undertakings).

Electricity Works, Townmead Road,
Fulham, S.W. 6.

Comparative Costs of Steam and Electric Drive.

The problems stated by "Steam" in your issue of March 1st should not be difficult to solve. He will, however, be compelled to give more information about his factory before a reliable conclusion can be drawn.

The most essential points to be considered are:—He says "one (boiler) is used specially for the driving." What are the others used for? Could steam be abolished altogether? If not, what proportion of this boiler plant must be retained?

What are the rates of labour, and how many stokers and enginemen does he employ, and what are their annual earnings?

What are his maintenance, interest, and depreciation charges on his existing boilers (for power), engine, shafting, &c.?

What is his actual (power) coal bill per annum, and has he any ash or clinker removal charges?

Has he any indicator diagrams of engine showing actual H.P. developed at varying times during the working week (*a*) with all machines working; (*b*) with all machines idle; (*c*) with various groups of machinery working, such as apparently is possible from the suggested grouping for the electrical drives?

What is the actual or calculated mechanical efficiency of his engine?

What would be the price per unit he would be asked to pay to the Corporation?

As regards the three schemes he suggests for electric driving, probably No. 3 would prove the most economical in running costs, but would involve the greatest capital expenditure.

Tom Hood.

Bristol, *March 5th*, 1918.

Heating Long Tubes Electrically.

The method of heating long tubes electrically, illustrated in your issue of February 8th, reminds me of a Canadian expedient. A hydro-electric plant was flooded out through the bursting of a penstock. This happened in zero weather—35° below zero—and we had first of all to remove 18 in. of ice from the power-house floor. Then we found that the cooling-water service to the bearings of the A.C. generators was still frozen solid. This was a 1-in. iron pipe embedded in the concrete floor, about a foot from the surface. We tried lighting fires on the floor, but the heat did not penetrate down to the pipe. Then our superintendent remembered the adage: "Do it electrically!" We had an exciter available, put clamps and cables at points where the pipe was teed off to bearings and came above ground, forced about 800 amperes through the pipe—and melted the ice.

The sad part of the story is—when the general manager came along and heard of our successful expedient, he merely said:—"What in heaven do you fellows think would have happened to you if you had burnt out the exciter? You were running at about 200 per cent. overload!"

E. Scott Rivett.

Huelva, Spain, *February 28th*, 1918.

A Rotary Problem.

May I ask, through your columns, if any reader will give reasons for the following occurrences on a 1,500-KW. rotary?

The segments of the commutator are alternately light and dark, the dark ones having a better and smoother surface than the light ones. The edges of the segments can be seen to be burnt, through a microscope.

The + brushes pick up copper on their faces, and yet are burnt up to half-way across the face from the leading edge. Copper dust also collects on the + brushes and holders, but the negative brushes are free from this dust, and their surfaces are excellent. This copper dust, magnified, has every appearance of having been burnt.

R.

LEGAL.

Harrison *v.* Morris.

In the City of London Court, on March 7th, before his Honour Judge Atherley Jones, K.C., an action was brought by Mr. Harry Harrison, trading as the Whitworth Electric Lamp Co., 75, Woodstock Road, Chiswick, against Mr. A. Morris, trading at the Premier Stores, motor outfitters, 165, Fleet Street, E.C., to recover £36 5s. for electric lamps and batteries supplied, as follows:—200 Midgets at 11d., 200 Baby Midgets at 9d., two gross 2-cell thick 13s. 3d., and three dozen 3-cell thick 18s. 6d. Mr. Lipson Ward appeared for the plaintiff, and Mr. Emile Cannot for the defendant.

Mr. Ward said that the claim was for damages for breach of contract by which defendant sold plaintiff batteries for electric torches, with which everyone was familiar to-day. There was an interview on January 5th between plaintiff and defendant, who had done business before frequently. Plaintiff was shown the Midget battery. It had the distinctive mark of "Master" upon it, and was in a red covered case. He ordered 200 Midgets. It was an American article. Of course, in selling things like electric batteries a particular brand was of great importance, because customers asked for the same kind of thing that they had bought before. Plaintiff also bought 200 Baby Midgets. There was no dispute about them, as plaintiff was abandoning his claim for a return of the £7 10s. which he had paid for them. He had paid for all the batteries which he bought of the defendant. Of the Midgets delivered 54 were not as described, as they were not marked "Master," and they were in black cases. Plaintiff refused to accept them, and he claimed £2 9s. 6d. in respect of those. As for the two gross 2-cell thick, the contract was for the sale of Jupiter batteries, which ought to have been manufactured by, and borne the distinctive label of, the Jupiter Co. Instead of delivering two gross he delivered 164. Plaintiff returned the goods not according to order, and now demanded the return of his money. Plaintiff further bought 500 flat batteries, known as "ordinary," and they were to be the same as he had bought before, marked "E.B." The batteries sent were a different kind altogether. For that reason plaintiff refused to accept them, saying they were not according to contract, and he returned them. He now claimed the return of the money which he had paid. Defendant had paid £3 3s. 4d. into Court, with a denial of liability for 76 batteries, which he admitted were faulty.

Mr. Cannot said that the defendant would have taken them back if they had been sent separately, but they were sent with other goods which defendant would not accept. Defendant gave no guarantee as to the description of the batteries sold, but, as a matter of fact, they were all Jupiter goods.

Mr. Ward added that the defendant had offered to abandon his profit of 3d. per dozen on some of the lamps if plaintiff would accept them. There was an express contract to take the batteries back.

Mr. Cannot said that the defendant was willing to have taken back the batteries if sent "at once," and that was not done. The fluctuations in the electric battery trade were very sharp and very great. The price depended on the demand at the moment.

Judge Atherley Jones could quite appreciate that the words "at once" must be taken having regard to the conditions which prevailed. One must consider the exigencies of the delivery companies and the various transport services, and see if there was reasonable expedition on the part of the party returning the batteries.

Mr. Cannot said that Jupiter batteries were supplied with the company's usual three months' guarantee. There could be nothing in the change of the colour of the label, which was unavoidable, having regard to the present-day paper difficulty. The goods were genuine Jupiter batteries.

Judge Atherley Jones thought that the defendant took up a high position when he said he would take back all the goods and return the money. He seemed to have repented of it since. All commercial transactions would be at a standstill, and, indeed, in a complete state of chaos, if that could be done with success, assuming there was due negligence in returning the goods.

Mr. Cannot said there was not. The market price had substantially decreased during the time which plaintiff lost.

Plaintiff said he received defendant's letter on January 10th telling him to return the goods. He tried to get them away by going to two carriers, but they were so busy and short-handed that it was impossible to handle them at once. He went to Carter, Paterson & Co., who promised to collect the goods on January 12th. They did not call for them until January 14th, and they were delivered to the defendant the next day. Then he refused them. They could have been sent in a taxi-cab, perhaps, but they were bulky, and weighed over 100 lb., and would have been refused probably. Prices did not fluctuate from January 10th to the 15th, as alleged.

Mr. J. Beny, manager of the Remoline Co., who manufacture Jupiter electric batteries, said there had been a big fluctuation this year owing to the fact that there had not been the fog this winter which was anticipated. There were very big imports, which came into Liverpool, intended for the Christmas trade, but which arrived the second week in January, and as there was no demand for electric lamps this year because of the increased price, most of the manufacturers were left with a lot of goods on their hands. From January 7th to the present time the prices of batteries had been on the downward grade. Batteries had been selling at 15s. 6d. per dozen, but the price was now 8s. per dozen. On foggy nights there was a demand for electric torches. They could not guarantee batteries now as they used to do, because the raw materials were not guaranteed to him. He could not produce such a perfect battery as he could before the war, because all chemicals had depreciated, and he could get no guarantee with chemicals. To shopkeepers he gave two months' guarantee. If the lamp depreciated they exchanged it within the two months. But once the seal was broken by the customer the lamp was not exchangeable at all, and they might only give half-a-dozen flashes.

In cross-examination, Witness admitted that transport difficulties were very great, but he did not think he had recently taken a week in which to deliver batteries to the plaintiff. It would not be unreasonable, however, to take a week. Then he was not under a contract to deliver at once.

Judge Atherley Jones, K.C., said he was always anxious that decisions in law courts should not conflict with commercial usage or restrict the proper play of commercial enterprise. He was perfectly satisfied that the plaintiff had done his best to return the batteries as soon as possible, and that he had not been guilty of any unnecessary delay. Judgment must be given for the plaintiff for the amount claimed, with costs.

Mr. Cannot said the defendant would appeal, and he asked for a stay of execution, which was granted.

Workman's False Time Sheet.

A fine of £5 was, at the Manchester City Police Court, on Tuesday, imposed on George T. Ward, a workman employed by Messrs. Pearson's, electricians, Hulme, Manchester, for making a false statement in his time-sheet. For the prosecution, it was stated that the defendant's earnings as an electric welder amounted to from £10 to £12 per week, and, in addition, his wife and daughter were earning £4. Defendant was sent by his employers to a contract job at Stroud, but instead of catching the 6 p.m. train on the Monday night he travelled next morning, and charged his time up from six o'clock on the Monday, whereas, in point of fact, he did not start work till four o'clock on Tuesday afternoon.

For the defendant, it was stated that he thought he was justified in charging his "time" from the hour at which he should have caught the train for Stroud, which he missed.

Marconi's Wireless Telegraph Co., Ltd.

In the King's Bench Division, on Tuesday, Sir Fredk. Smith (Attorney-General) mentioned to Mr. Justice McCardie the petition of the Marconi Wireless Telegraph Co., Ltd., to the King, which was down for hearing before his Lordship. He said that he appeared with the Solicitor-General (Sir Gordon Hewart), and that Sir Edward Carson was leading counsel for the plaintiffs. Sir Edward was indisposed, and could not possibly be there that day. It was a very important case affecting the construction of a contract, and indirectly affecting a very large sum of money. Sir Edward asked his Lordship's indulgence to this extent, that the case should be postponed till Thursday.

Mr. Justice McCardie ordered the case to stand adjourned to Thursday.

Osram Lamp Litigation.

In the Chancery Division, on Tuesday, Mr. Justice Paterson had before him two motions for judgment in the matter of the Osram-Robertson Lamp Works, Ltd., *v.* Malmberg, and the same plaintiffs against the Ostro Light Co.

Mr. J. Hunter Gray said the first case came on as a motion for judgment by consent on agreed minutes which provided for a perpetual injunction, delivery up, and inquiry as to damages, together with costs of the action, costs of the inquiry to be reserved. The second case came on as a motion for judgment in default of defence in respect of the same patent, and the minutes were identical.

His Lordship gave judgment for the plaintiffs in each case in the usual form.

WAR ITEMS.

Exports to China.—The "London Gazette" for March 8th contains names of some further persons and bodies in China to whom exports may be consigned.

Electric Supply Staffs and National Service. The following letter has been received by Mr. T. W. Cole, secretary of the Provincial Electric Supply Committee, from the Ministry of National Service, and it is to be noted that the assistance that may possibly be given by the Ministry (as mentioned therein) may be of considerable value in certain cases. The booklets mentioned therein may be obtained at H.M. Stationery Office, Imperial House, Kingsway, W.C. 2., viz.: —R.136, List of Certified Occupations (June 23rd, 1917), price

1d.; M.M.130 (revised), Schedule of Protected Occupations (February 1st, 1918), price 2d.

(Copy.)

Ministry of National Service,
Room 130, Westminster, S.W. 1.
February 20th, 1918.

Dear Sir, In reply to your letter of February 14th, I have to say that certain men engaged in electrical generating stations are covered by the Schedule of Protected Occupations where such undertakings are certified by the Ministry of Munitions under the Munitions of War Act (see page 28 of copy enclosed). Communications on the subject of men employed in such undertakings should be addressed to the Labour Supply Department of the Ministry of Munitions, 6, Whitehall Gardens, S.W. 1.

As regards men not so employed, all applications and appeals on behalf of such men should be made to the Local or Appeal Tribunals, or to the Central Tribunal in the usual way, and the attention of the Tribunal should be called to the reservation in the List of Certified Occupations (see page 20 of copy enclosed). No guarantee can be given that it will be possible for this Ministry to take any action as regards men whose cases have been finally dismissed by the competent tribunals, those being the bodies duly appointed by statute to deal with such cases. If, however, an electrical undertaking attaches special importance to the retention of a particular man, and sends full details of the case to this Ministry in good time before the case comes before the Tribunal, it will receive careful consideration, and the Minister will consider whether instructions can properly be given to the National Service Representative concerned not to bppose the case before the Tribunal. The particulars required are —Man's name and registered address; employer's name and address; precise occupation of man; Tribunal history (nature of certificate of exemption held, and by what Tribunal granted); and any other form of protection held (*e.g.*, protection certificate under Schedule of Protected Occupations).—Yours faithfully, R. E. Graves. *Deputy Commissioner for Trade Exemptions.*

T. W. Cole, Esq.,
Provincial Electric Supply Committee,
Moorgate Court, Moorgate Place, E.C. 2.

Mr. Cole points out that the L.G.B. Regulations and Instructions to Tribunals, R.173, subsequently issued (dated March 4th), are interesting in connection with above, particularly the following:—

> Tribunals are not to hear an application by or on behalf of a man until they have been notified by the National Service Representative whether he assents or objects to the application (Regulation 26). If Tribunals find that there is delay in notifying them, they should communicate with the National Service Representative. An application may be granted without a hearing where the National Service Representative assents, and the Tribunal are satisfied that it should be so granted (Regulation 26).

Exemption Applications.—At Wrexham, on March 4th, the Wrexham & District Traction Co. appealed for W. Jones (32, C 1), electric tramcar driver, and six months were allowed.

At Hastings, an appeal was made for R. Merrifield (Class A), electrical fitter for 18 years with Mr. F. Wordley. The latter said that his firm kept another man's business going, and they were engaged solely on commercial work, and had failed to find a substitute of any sort. The Tribunal allowed a final two months, the man to join up earlier if a suitable substitute is found.

The Bedford Tribunal has decided to withdraw exemption held by T. Wright, electrician at the Theatre, unless he complies with the Volunteer condition within 14 days.

Before the Surrey Appeal Court, Messrs. Reed & Co. appealed for E. Lownes (31, Class A), in charge of the electric plant at Farncombe Mills, and he was given a final two months.

The Weymouth Tribunal has granted conditional exemption, until an efficient substitute is provided, to H. J. Barrow (36, passed for general service), electrical wireman with Messrs. Brooking & Co., electrical engineers.

At Leyton, the National Service Representative appealed against exemption granted to E. G. Francis (33, Class A), motorman on the U.D.C. tramways, and he was put back until a substitute is found.

The Enfield Tribunal has granted three months' exemption to S. C. Wisbey (39), engineer and storekeeper with the Ediswan Electric Co., Ltd.

At Folkestone, the National Service Representative applied for the withdrawal of conditional exemption granted to Messrs. Cripps and Payne, switchboard attendants at the electricity works, on the ground that they had failed to fulfil the conditions by not attending the drills with the Kent Volunteer Regiment. Mr. T. Hesketh, manager to the Electricity Co., said that it would have been possible for the men to have attended the drills, and he regretted that they had not done so. Important work was being done by the company, and he was in no way anxious to keep the men if he could find skilled substitutes. Unfortunately, he could not do so, and his staff was already reduced to a minimum. Mr. Swoffer (a member of the Tribunal) said that he had been told that a man applied for the post of switchboard attendant, and offered to work for nothing until he was trained, and that Mr. Hesketh had refused his services. Mr. Hesketh replied that this was quite likely. He could get any amount of unskilled labour, but what he wanted was skilled men, and they were entirely unobtainable. All his apprentices had gone, and both the men appealed against had made arrangements to join the Royal Flying Corps, and might be called upon to join up at any moment. The exemptions were withdrawn.

At Brixworth (Northants), Earl Spencer appealed for further exemption for the electrical engineer at Althorp House (34, B 2), and he was given until May 1st, with regrading in the interval.

At Colchester, on March 4th, exemption was sought for F. Howard (18, Grade 1), electrician at the Hippodrome, but he was directed to report for service by March 30th.

At Broadstairs, on March 5th, the Isle of Thanet Electric Traction & Lighting Co., Ltd., asked the tribunal to waive the Volunteer condition imposed with conditional exemption granted to two employés, and the request was acceded to.

At Deptford, exemption was applied for E. Brown (39, Class A), sole electrician at the mills of Messrs. Lake, and three months were granted, with leave to appeal again.

Before the North Devon Appeal Court, appeals were made by the Military against G. W. Branch and F. Bickford, both in Grade 3, electricians, of Barnstaple, who had been granted six months' exemption by the Local Tribunal. The appeals were disallowed, and the exemptions confirmed.

Rochdale Tribunal, on the recommendation of the Advisory Committee, has granted exemption until June 30th to F. Walton (29, C 2), overhead linesman, and R. H. Hogg (38, C 1), motorman, applied for by the Corporation tramway department.

BUSINESS NOTES.

Easter Holidays.—The Electrical Review for March 29th will, as usual in Good Friday week, appear two days earlier. In consequence thereof, it will be necessary for all correspondents, contributors, &c., to send in their matter well in advance of the usual time. A notice concerning advertisement copy arrangements for the week will be found in our advertisement pages to-day.

Book Notices.—"Register of Overseas Buyers." London: Bemrose & Sons, Ltd. £1 1s. net.—This is the first edition of a work published for the use of British producers, manufacturers, and merchants. It consists of a list of buyers, agents, and importers in our Colonies and Dominions and in Allied and Neutral countries, together with information on Customs, tariffs, imports and exports. It is stated that it has been compiled with the assistance of Chambers of Commerce and H.M. Consuls abroad. Firms interested in after-war trade projects will need publications of this character.

About British Magnetos is the title of a handsome brochure which has been issued by the Publicity Department, British Magnetos, 8, Breams Buildings, E.C. 4, explaining why so few magnetos were made in this country before the war, how the Germans captured the trade, and how the outbreak of war, by cutting off the supply, resulted in the creation of a practically new British industry, entailing a vast amount of research work and experiment, but leading to the evolution of better magnetos than were ever imported. The success attained was largely due to the formation of the British Ignition Apparatus Association, embracing nine firms which are co-operating in the production of interchangeable standardised machines of the highest class. The achievement undoubtedly represents a triumph of British energy, organisation, and technical skill, and the brochure, which can be obtained on application, admirably illustrates the machines and their applications in war-time.

"What Industry Owes to Chemical Science." By R. B. Pilcher and F. Butler-Jones. London: Constable & Co. Price 3s. net.

"Mathematics for Engineers." By W. N. Rose. London: Chapman & Hall. Price 8s. 6d. net.

"The Electron." By R. A. Millikan. Chicago: The University of Chicago Press. Price $1.50 net.

Advice Respecting the Italian Market.—In the *Bulletin* of the British Chamber of Commerce for Italy (Inc.) for October-December there is a good deal of matter relating to the need for effort to expand trade between Britain and Italy. At a meeting of members held at Genoa, in December, one of the speakers, Mr. Albert de Thierry, urged that the very first step to take was the reform of British weights, measures, and currency. He said that in the good old days British trade was paramount, and if we had been beaten, it was by superior organisation. Conservatism was played out, and British manufacturers must take into account the real needs of the country; the consumer must be studied, and the coming trade war would be terrible. If firms in Britain would help them in the little things that made for increased trade, they could be sure of going ahead. He thought that British firms had had so much business in the Colonies that they had forgotten the old markets, but he knew British manufacturers who were already preparing to cater for Italy. We sold on bill of lading in English currency; the Germans delivered into the customer's store in Italian liras. Lieut.-Colonel Lord Hythe, who has been visiting the various branches of the Chamber addressing members, in the course of an address at Tuscany strongly impressed on those present the necessity for deciding now what was to be done and in what direction we were to supplant German goods on the Italian market after the war. He insisted on the necessity of all Britishers pulling together, this having been the strength of the Germans. A very important question was the supplying of raw materials and machinery. Several hydro-electric railways were contemplated in Southern Italy, and Great Britain would be interested therein. A later speaker (Count Parravicino, of Florence) stated that cheap transport was essential; only high-class, expensive goods could afford coming by rail, while the more necessary raw material and cheap goods came by sea after a lengthy and costly voyage. "German success had been largely through cheap and fast transports. Sample showrooms were also a very good thing. Business must be canvassed for by good agents and travellers knowing Italian. The system of developing industries in Germany was more perfect that in England; they made quite a study of it. He instanced the establishment of industrial schools, and very especially the sending out of young men to foreign countries to study languages, business methods and trades, whereby they acquired knowledge of the needs of every country. Their banking organisation had also largely contributed to German success, and it would be necessary to institute a similar financial organisation."

Elsewhere in the *Bulletin* there are collected extracts from letters, &c., relating to the question of competition and ways and means for furthering export trade. The German organisation for resuming the export trade is stated to be very complete, and the view is emphasised that, without better organisation, we cannot expect to keep pace with other countries. Germany is stated to be unabashed, unashamed, and confident that she will push her way into the world's markets again. Though German ships have been driven from the seas, Germans have not let the grass grow under their feet. "The more we scan the export horizon, the more the need for the thorough reorganisation of British trade becomes obvious." "Germans . . . with less original genius or inventiveness, but with a greater readiness to face new business problems in a practical spirit, ingratiated themselves into markets in our own domains or at qur very doors." One writer summarises legitimate and illegitimate German methods as follows :—

German legitimate methods :

1. Sending a traveller and having a resident agent for each country.
2. Supplying better-finished goods and articles better adapted to the country than British manufacturers offered.
3. Issuing catalogues in various languages.
4. Selling their goods in foreign money duty paid, and giving weights and measures in kilos. and metres.
5. Putting up their goods in more attractive style, and labelled in Spanish, &c.

Illegitimate methods :

1. Putting British trade marks on their very worst quality goods.
2. Putting up their cheapest rubbish on cards, or in boxes, printed in English.
3. Buying British patented articles from England in tens or grosses (to cover themselves), but making infringements of the same article in hundreds of grosses and selling both together.
4. Generally infringing British patents and marks when it paid to do so.

We quote one other writer, who says that before the war Germany had almost a monopoly of the importation of machinery into Italy. This was the natural consequence of Germans having got control of the most important banks, who made it almost a speciality to finance the leading manufacturing companies in Italy. By this means the German financiers, closely in touch with the German industrial rings or "cartels," were able in most cases to control the affairs of these companies, and to obtain all plant or machinery required from Germany, or from other German-controlled companies in Italy. Only very few important concerns were outside this German influence. The writer continues :—

> With regard to the future, I think that the industrial development that has taken place in Italy during the war will render this country much more independent than formerly, as far as the mechanical industry is concerned, so that in no case will it require imports from abroad to anything like the scale it has done up to now. However, owing to the dearth of fuel and iron, Italy will always be unable to compete with the larger manufacturing nations for the manufacture of heavy machinery where coal and iron are the principal items, so that it will always continue to be a large importer of this class of machinery. If the British machinery manufacturers desire to seriously tackle this market, it will not be sufficient for them to send down travelling agents and a quantity of illustrated catalogues and other interesting literature dealing with their manufacture, but they will have to organise well equipped offices, shops and showrooms fitted with a large selection of their products, full sets of spare pieces, repairing shops, &c., in the principal industrial centres, and hand over the management of these agencies to able and well-paid people, who would be required to keep in close touch with the management of the big limited liability companies who are almost the sole purchasers of this class of articles. The British manufacturers ought also to be prepared in some cases (like the Germans) to give long credits, and occasionally also to accept part payment in the form of shares or debentures in the companies of their clients. Of course, these facilities would only be granted after the closest examination into their clients' business, and with the participation of one or more representatives on the board of directors of the purchasing companies.

Electrical Imports of Chile.—In an article advocating the creating of new industries in Chile, the *Boletin de la Sociedad de Fomento Fabril* gives the following particulars of Chilean imports of electric glow lamps in the four years 1912 to 1915 :—In 1912 there were imported 159,651 kg., of a worth of $798,205 ; 1913, 214,938 kg. = $1,074,690 ; 1914, 79,201 kg. = $396.005 ; and 1915, 91,392 kg. = $459,960. The year 1913 may be considered a normal year, and the contributing countries were as follows :—Germany, 169,472 kg. = $847,360 ; United States, 32,160 kg. = $160,550 ; Great Britain, 7,850 kg. = $39,250 ; France, 2,051 kg. = $10,105 ; Belgium, 1,793 kg. = $8,965 ; Holland, 1,135 kg. = $5,675 ; and other countries, 557 kg. = $2,785. Glow lamps are subject to a Chilean Customs duty of $0·04 per kg., but the *Boletin* advocates in the interests of the native industry an increase to $2 per kg. Other electrical imports in 1913 were to the following extent :—Machines and electrical apparatus, 1.836.421 kg. = 1,198,490 ; machines and accessories for electric lighting, 2.928,565 kg. = $1.807,340 ; telephones, 3,130 kg. = $136,061 ; telegraphic apparatus, 1,109 kg. = $4,742 ; insulators for telegraphs and telephones, 333,110 kg. = $266,488 ; accessories for telegraphs and telephones, 144.855 kg. = $151.637 ; making a total of $3.564.758. The above figures are exclusive of electric motors and electric traction material. The *Boletin* points out that the Chilean market affords a steadily increasing opening for electrical plant throughout the whole of its territories, and in particular for telegraphs, telephones, lighting, traction and motive power, and electrolysis. Moreover, machines, apparatus, and instruments for electrical industries enter the Republic duty free.

Rubber Stocks in Brazil.—According to a Rio de Janeiro dispatch to the *Financial Times*, a large quantity of the 1917 crop from the Amazon States, Matto Grosso, and the Acre territory is accumulating on the quay at Manaos. The Federal Government in order to remedy this had ordered Brazilian steamers on their way to the United States to call at Manaos. As, however the American market was not sufficient outlet, the Minister of Commerce asked the Brazilian Lloyd to commence a monthly service direct from Manaos to Liverpool. This service is now going regularly, and will continue until the Amazon rubber has been cleared off and the difficulty solved.

Trade Announcements.—Messrs. Simpson Brothers, electrical engineers, North Street, Hapton, Burnley, have secured additional premises for their magneto works.

In consequence of the Government having commandeered their Kingsway offices, the Keighley Gas and Oil Engine Co., Ltd., have removed to Albion House, 59-61, New Oxford Street, London, W.C. 1.

Catalogues and Lists.—Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E. 7.—A number of new illustrated leaflets dealing with transformer pillars, H.T. transformers for test-room and other purposes, outdoor sub-station transformers, and E.H.T. transformers for special purposes. Booklet of ten pages, giving data and net prices relating to their V.I.R. cables.

Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C. 2.—Eight-page illustrated list, giving particulars and prices of their Sun portable electric tools—grinders, drills, and buffers—such as are being used in aeroplane factories and munition works.

Furnace Developments.—The Davis Furnace Co., of Luton, report that during the last two months the character of the demand for furnace plant has totally changed. Whereas for the last two months of 1917 about 85 per cent. of their orders were for crucible furnaces for metal melting, for the first two months in this year the position is reversed, and now at least 80 per cent. of their orders are for furnaces of the oven type, principally for heating steel billets and plant for tool-making purposes, increased pressure upon contractors by certain Government departments being accountable for the change.

Liquidations.—British Huhn Metallic Packing Co., Ltd.—A petition for the winding up of this company, presented by the Board of Trade in the matter of the Trading with the Enemy Amendment Act, is to be heard on March 19th.

LIGHTING AND POWER NOTES.

Australia.—The report of the Sydney Electric Light and Power Supply Corporation for the half-year ended October 31st shows net profits £15,724, compared with £13,430 in 1916. A dividend of 8 per cent. per annum was paid, £5,100 was allocated to depreciation, making a total of £37,602, and the reserve fund stands at £38,110. The total share capital is £216,479, and the debentures £60,800.—*Sydney Daily Telegraph*.

Birmingham.—Price Increase.—The City Council, at its last meeting, approved of the recommendation of the Electric Supply Committee to raise the prices charged to high-tension consumers by 10 per cent., to be added after the Coal Clause has been taken into account ; and for low-tension supplies by 15 per cent. Alderman Jephcott, chairman of the Committee, stated that the charge to the tramway department for traction supply would also be increased by 10 per cent., to be added after the Coal Clause had been calculated.

Bonnybridge.—The bursting of a large cast-iron pipe at the works of the Scottish Central Electric Power Co. caused serious dislocation of work throughout Stirlingshire and Linlithgowshire. Over an area of 400 sq. miles, labour in a large number of iron and steel works, brick works, and collieries was entirely suspended. In a number of the steel works the furnaces, which were fully charged, cooled, necessitating the blasting of the solid contents.—*Evening Gazette Aberdeen*.

Bootle.—Linking-up.—Asked at the Town Council as to the progress of the scheme for the interconnection of the electricity undertaking with that of Liverpool, Mr. Scott said they agreed to the principle of the agreement in January, and did not want winter to come again before they were connected. The Mayor stated that both sides were now practically agreed upon the matter, though the agreement had not been actually signed.

Bradford.—Price Increase.—The Electricity Committee has decided to recommend the City Council to increase the charges for electricity from April 1st as follows :—Bulk supply and power users (including long-term contract holders) to pay, in addition to the existing basis rates, ·015d. per unit for every 6d. or portion of 6d. per ton increase in the price of coal over and above 9s. per ton ; the accounts of all other classes of consumers which are not subject to the coal clause to be increased by 20 per cent.

Braintree.—Proposed Prov. Order.—The U.D.C. is considering a draft agreement, with prices and terms, submitted by Messrs. Crittall in connection with the prov. order for which they are applying.

Canada.—Conservation of Electric Power.—By an Order, dated January 8th issued in regard to the conservation of power in Ontario all commissions, companies or persons generating, distributing or using electrical energy in Ontario where there is a shortage of energy or where energy is being generated or supplemented by steam, gas, or oil plants, are directed to practise strict economy in the use of electrical energy. The commissions, companies, and the officers of corporations, as well as individuals using electrical energy, have been enjoined to see that no electrical energy is being used for advertising or ornamental lighting; that electric street lighting is reduced to the utmost possible limit—discontinuing cluster lighting entirely, and only using such lamps as are actually necessary for the safety of the public. The Hydro-Electric Power Commission of Ontario has also issued an Order, dated January 8th, to the same effect, addressed to municipalities, commissions, companies, or persons being supplied by the Commission. It has been decided to spend $1,800,000 on an addition to the plant of the Ontario Power Co., which the Commission acquired last year. This will provide 50,000 additional H.P. before the end of 1918, about 15,000 of which will be available for use by August next. The matter is considered of such urgency that the necessary machinery and plant will be purchased with the least possible delay.

Carlisle.—Price Increase.—The Electricity Committee of the T.C. has increased the charges for energy by 5 per cent., making an increase of 25 per cent. upon pre-war charges, as from the meter readings for the current quarter.

Clayton.—Prov. Order.—The District Council, last week, decided unanimously to oppose the application of the Electrical Distribution of Yorkshire, Ltd., for a prov. order to supply current to Clayton, and resolved to accept the Bradford Corporation's terms of supply.

Continental.—Italy.—Further limitations have been imposed in Rome on the use of electricity for both lighting and heating.—*The Times.*

There has been formed at Rome the Società Mediterranea di Elettricità Anonima, with a capital of 11,000,000 lire, whose objects are the discovery and utilisation of hydraulic powers, the acquisition of concessions for the same, the production of electrical energy, the erection of plants for the same objects, &c.

An exhibition has been organised and held by the Associazione Elettrotecnica Italiana in the Salon of the Associazione Industriali at Milan of electric welding machinery, which has excited keen interest. The exhibition was intended to be for one day only, but was extended to three in consequence of the concourse of those interested in technical matters attracted to the display and demonstrations. The Under-Secretary of State, Signor Bignami, the local Industrial Mobilisation Committee, and the Ministry of Industry sent delegates. The exhibitors comprised the leading Italian electrical firms, the State Railways, &c. A paper on the results of the experiments and on the various exhibits was compiled and read by Prof. Lori.

At the outbreak of war the water power utilised in Italy for the generation of electric motive power totalled 1,000,000 H.P., and to reach this figure a period of 30 years was necessary; lack of initiative and capital were the chief hindrances which caused this slow growth of the electrical industry in Italy, notwithstanding the great store of water power available. The industrial activity provoked by the war had a great influence on the development of the electrical industry. Since the first dispositions made by the Government in favour of the industry, the applications for water concessions for electric uses have been steadily augmented. Concessions totalling over 250,000 H.P. are already planned and under way, while favourable reception has been accorded to concessions standing for 500,000 H.P. If to this large aggregate of 750,000 H.P. be added the 1,200,000 H.P. utilised without lawful title, this gives some 2,000,000 H.P. which will in a few years be in full working condition. In later years there have been concessions granted for water supplies of exceptional importance, such as the "Sila," in Calabria, for over 100,000 H.P., and the "Orco," in Piedmont, for 70,000 H.P. Recently the investment of capital in the electrical industry has increased considerably, as witnessed by a net total of new investments of 108,090,000 lire for the first half of 1917. This increase is more than double the average yearly increase for the period 1910-1916. To this remarkable increase must be added those not negligible sums invested in the construction of hydro-electric plants by metallurgical companies to provide directly the energy needed for the manufacture of military material. Electric share companies, indeed, occupy the foremost rank among industrial companies in the official statistics as regards capital invested, and thus the electrical industry at length takes the leading place both financially and industrially, and has before it a promising future.—*Società per Azioni Rivista Tecnica d'Elettricità.*

Doncaster.—Wages.—Employés in practically all Corporation departments, to the number of about 250, who are members of the National Amalgamated Union of Labour, last week gave seven days' notice of intention to cease work unless their demands for an 8s. per week advance for men over 18, and 4s. for youths, were conceded. They rejected the Corporation's offer of 3s. The matter has been referred to the Committee on Production.

Exeter.—Wages.—The City Council has agreed to increase the pay of the members of the technical and clerical staffs of the electricity department on a scale corresponding to that of the finding of the Committee on Production.

Leith.—Proposed Extension.—The electrical engineer, reporting on the proposed extensions to the generating plant at the electricity station recommends the installation of two new generators, each of 1,500-KW. capacity at a cost of approximately £53,000 for D.C. plant and £62,500 for A.C. plant, with all accessories. The report has been remitted by the Town Council to the Management Sub-Committee.

London.—Hammersmith.—The Electricity Committee considers it necessary to insure against air raids the stock of coal at the electricity works, in the sum of £22,500.

The Committee reports having granted the applications of the L.C.C. and the L.G. Omnibus Co. for electricity for the illumination of certain signs during the necessary lighting hours, at the rate of £5 per 60-watt lamp per annum.

Manchester.—Clerks' War Bonus.—A suggestion that the wages awards granted to the clerks in the Dickinson Street electricity generating station should be extended to the clerks in the electricity department at the Town Hall, was deferred at the City Council last week. It was explained that an award was expected shortly that would include a system of grading.

Morecambe.—Price Increase.—The T.C. has advanced the price of energy as from April 1st to 6½d. per unit for lighting and to 3½d. for power and heating.

New Zealand.—Year's Working.—The report of the second year's working of the Lake Coleridge hydro-electric power undertaking to March 31st last shows total revenue of £20,754, as against £8,518 in 1916, working expenses £12,889, gross profit £7,865, interest and depreciation £19,821, total deficit (including depreciation) £11,956, as against £17,649, the result of the previous year's working. Mr. Evan Parry, the chief electrical engineer, reports that the rapid growth of the business indicates that by the end of the current year (the third year of operation) the plant will be earning sufficient to meet both interest charges and working expenses, and will yield a surplus for depreciation and reserve. The total capital expenditure was increased during the year from £320,930 to £336,984, the main item of expenditure being the installation of a fourth generating set of 1,500-KW. capacity, raising the total power-house capacity from 4,500 KW. to 6,000 KW., equivalent to 8,000 H.P.; a fifth turbine and generator set of 3,000 KW., together with material for additional pipe lines, has been on order for some time. Total connected load 17,083 KW., energy sold 11,664,961 KW.-hours, as against 3,994,769 KW.-hours in 1916; maximum load, 4,366 KW., as against 1,372 KW.; average weekly load factor, 52·9 per cent. Arrangements have been made with the Christchurch (N.Z.) Tramway Board for the use of the whole of their steam plant, amounting to 2,000 KW., for stand-by purposes.

Proposed Hydro-electric Development.—The New Zealand Government authorities are having a report prepared upon the question of the development of hydro-electric power in the Province of Southland. Southland has the largest amount of undeveloped water power in New Zealand, and it is proposed to develop a scheme that will yield sufficient power to serve the whole of the province. The Southland League (Inc.) has asked the Government to place legislation on the Statute Book enabling districts such as Southland to carry out their own schemes of electrification. The proposed scheme is based upon the "Local Railway Act."

It is realised that the actual supply of plant by United Kingdom firms is hardly possible under existing conditions, but the information furnished may be of interest as an indication of developments which will undoubtedly become of great importance in the future.

Oldham.—War Bonus.—The T.C. has decided to grant a further bonus of 12½ per cent. to all employés in the electricity department, in accordance with Sir George Askwith's award, but the application for a further 5s. war bonus per week has been refused.

Pembroke (Dublin).—L.G.B. Inquiry.—Mr. P. C. Cowan, chief engineering inspector of the Irish L.G.B., held an inquiry, on Monday, last week, into the application of the Urban District Council for sanction to a loan of £10,000 for the completion of the scheme for extending the electricity supply.

Power Bill.—Worcester City Council is among the latest to oppose the Bill being promoted by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. It was reported at the last meeting of the Council that on the initiative of the Wolverhampton Corporation it had decided upon a united course of opposition. There were now 22 petitions against the Bill.

Salford.—War Bonus.—In discussing the question of war bonuses, last week, Ald. Phillips said the Corporation was paying in war bonuses a sum equivalent to £29,800 annually to gas workers, £45,000 to tramway workers, £10,500 to electricity workers, and to other departments certified under the Munitions Act, £52,000, or a total of £137,400. If the Committee on Production acceded to requests from some of the departments for a further bonus, there would be a further sum of £61,500 required, and if on lines of justice and equity they dealt with the uncertified workers, there would be a further increase of £47,000. If what he anticipated came about, the total payment would be £246,000, or more than £1 per head of the population. Including the amount they would have to pay under the more recent increases, the sum was equal to a rate of 4s. 2d. in the £, and, with others.

that would probably reach 5s. 1½d. The worst of the situation was that some men were getting more than others without adequate reason. Electricity workers were getting 20s and 12½ per cent., but he doubted very much that the cost of living to those was more than it was to the uncertified employés who had been receiving 12s. a week bonus. The Council decided to increase the latter bonus to 14s.

Bulk Supply.—At the Town Council, last week, Councillor Billington, chairman of the Electricity Committee, referred to the increased use of electricity in the borough, and hoped that the Council would support the Committee in its proposal that the Manchester Corporation and the Lancashire Electric Power Co. should supply energy in bulk to Salford. Salford was handicapped, he said, in possessing an old station which could not be extended owing to the war. The Committee had carried out certain improvements, however, which had enabled it to increase the output from 15 million units in 1914 to 32 million units, and, despite the big expenditure, it had reduced the debt very considerably. As it could not meet the present demands, it must ask for outside help. The Council approved the proposal.

Sheffield.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £11,125 for railway sidings and capstans, cables and auxiliary board, fans for boiler house, accumulators, coal shoots, &c., for the electricity undertaking.

Stoke-on-Trent.—Plant Extension.—The T.C. has applied to the Ministry of Munitions for a priority certificate for additional plant at the electricity works. It has been decided that new electrical services cannot be granted at the present time to houses where gas is already installed.

Swansea.—Price Increase.—Owing to the cost of production having increased by 80 per cent. in wages and 84 per cent. in fuel, the engineer (Mr. J. W. Burr) recommends that a war charge of 12½ per cent. be added to all accounts for electrical energy, except contracts. The Electricity Committee has agreed to the recommendation, the charge to become operative from April 1st.

Tasmania.—The Government Hydro-Electric Department, owing to the increased demand, and the inability—owing to the war—to secure the necessary plant to supplement the supply, has taken steps to limit any further demand on the scheme for the present. The following regulations came into force early in the year :—No further extensions will be made to the department's reticulation system, and no further poles or distributors will be run to connect up consumers ; only approved lighting consumers will be connected, and these only where present distributors and transformers are of sufficient capacity. No additional electric heating or cooking apparatus will be connected to the department's system under any circumstances. Until further notice no motors whatever will be connected to the system. As soon as the position improves sufficiently the restrictions will be removed.—*Australian Industrial Mining Standard.*

Torquay.—Price Increase.—The T.C. has decided to increase the price of electricity for lighting by 1d. per unit, and for other purposes by ½d. per unit.

Wigan.—At the T.C., reference was made to the steady increase in the demand for electrical energy, and Councillor Alstead said he hoped the Committee would take immediate steps to get a sufficient amount of generating plant—nothing less than 100 million units ; if they went up to 200 million units they would be able to sell them.

Wolverhampton.—Price Increase.—The Council has decided that from and after the March readings of the meters the following increases shall be made in the charges for electrical energy :—Ordinary consumers not under contract, and paying over 1d. per unit, a further 30 per cent. increase, making a total of 50 per cent. increase over pre-war charges ; ordinary consumers not under contract, and paying 1d. per unit and under, a further 20 per cent. increase, making a total of 50 per cent. increase over pre-war charges.

Worcester.—War Bonus.—The City Council had before it, at its last meeting, the award of Sir G. R. Askwith stating that all plain-time-working employés in generating stations should receive a bonus of 12½ per cent. Mr. Hill, in moving that the increase be given, stated that it would mean an advance at the rate of £606 per annum. In addition, overtime money would have to be paid. The increase, with the advances already granted, would mean a total charge of £2,100 per annum in the department's wages list. The resolution was approved.

It was reported that the annual increased cost of production of electricity was £7,000. The Committee asked for authority further to increase the price of energy supplied to those establishments with whom it had contracts by ¼d. per unit, which would produce £1,000.

Workington.—Prov. Order.—It was reported to the T.C., on March 5th, that no opposition had been filed to the prov. order for electricity supply, and it was decided to go forward with the application.

York.—Price Increase.—The T.C. has decided to increase the charges for electricity by 33⅓ per cent. above pre-war rates, as from April 1st next, and to confer with large consumers as to an increase in the charges under contracts.

TRAMWAY AND RAILWAY NOTES.

Accrington.—At the T.C., Alderman Higham reported that the Tramways Committee had come to an arrangement with the Haslingden Corporation respecting the charges made by the Accrington authority for the use of its cars in the Haslingden area. The Accrington formula showed a difference of about £200 in its favour, as compared with the formula submitted by Haslingden, and this was the amount in dispute. Rather than involve themselves in costly arbitration and delays, it had been decided to divide the difference, two-thirds falling upon Accrington and one-third upon Haslingden.

Birmingham.—Wages Award.—The award of the Arbitrators of the Committee on Production with regard to the application by the Corporation employés in the gas, water, and tramway departments for the payment of 12½ per cent. bonus, has been received. It makes the award to the operatives in the gas and water departments, but excludes the motormen and conductors on the tramways.

Bolton.—Electric Vehicle.—The Cleansing and Sewage Committee has decided on the purchase of an electric motor wagon.

Bootle.—At the Town Council meeting, last week, Mr. F. W. King drew attention to the new agreement for the Bootle tramways just entered into with Liverpool, and remarked that in one item, for which they had accepted £41 per mile, there was going to be a loss to the Corporation of £365 this year, whilst next year the loss would be £326. This would come out of the Corporation's £500, reducing it to £135 this year and to £174 next year. He did not think there was much cause for congratulation.

Darlington.—At a meeting of the Town Council, on Thursday, last week, Ald. Sir Charles Starmer moved the adoption of the Electricity and Light Railway Committee's minutes, and said that there would be an increase in the revenue of the light railway department of considerably over £2,000 on the year, and he hoped that it would increase to £3,000 before the year closed. Increases in bonus had been granted to men, women and girls of the department.

Glasgow.—Year's Working.—The returns of the Corporation Tramways Department bring the figures up to March 2nd, the year beginning on June 1st, 1917. For that period the receipts total £1,039,334, as compared with £922,753 in the corresponding period of last year, an increase of £116,681. The number of passengers carried was 319,213,392, as against 288,402,417, an increase of 30,810,975.

Hull.—With reference to the notice that appeared in our last issue, this was based on a circular issued some time ago. It is only intended to relate to correspondence for the department of the tramway electrical engineer (Mr. J. Wilkinson), and *not* to all communications for the tramway department.

Liverpool.—Revision of Fares.—The Finance Committee recently recommended that the Tramways Committee be instructed to prepare a scheme for the revision of fares. Sir Charles Petrie contended that the Council was justified in asking that this should be done, in view of the enormous cost of running and maintaining the tramways. He estimated the extra cost this year as not less than £100,000. If the Corporation carried people the first two miles for 1d., and shortened the more distant stages, it was estimated that £70,000 would be brought in towards the cost of developments and renewals after the war. Councillor H. R. Rathbone said it was not business to hand over large sums of money in relief of rates, and then take back a large portion of it in increased fares. The Finance Committee's recommendation was approved.

Manchester.—At the City Council, Alderman Bowes gave an idea of what war bonuses, &c., were costing the tramway department, affecting about 4,000 employés. At present they were paying in general increases £134,780 a year ; on the 12½ per cent. basis, £5,283, with a further approximate amount of £37,034. If the London arbitration was in favour of the men, there would be another increase of £94,583, making a full approximate increased amount of £271,679 a year, to which must be added £56,000 paid to dependents of men at the front.

Oldham.—At the meeting of the Tramways Committee last week, the question was asked why men were leaving the Hollinwood depôt, and the reply was that the men were mainly labourers who had gone on munition work at a recently-opened factory, where handy men could command as much as £3 7s. a week. Provided the men left to go on munitions there was nothing to prevent them going, now that leaving certificates had been abolished.

Russia.—The Petrograd tramways ceased running on Saturday last owing to lack of fuel.—*Reuter.*

Plymouth.—The T.C. is again applying to the Board of Trade for sanction to borrow £8,600 for eight new tramcars, explaining that the amount can be raised out of the Corporation sinking fund.

Southport.—Sunday Service.—At a special meeting of the Tramways Committee last week, it was decided to recommend to the T.C. that a Sunday service be run in the whole of the borough. Hitherto, the only Sunday cars run have been those of the Southport and Birkdale Tramway Co., which system has just been acquired by the Corporation, and which service the Corporation has continued. On two occasions the ratepayers of the town have recorded substantial majorities against Sunday tramcars.

Threatened Tramway Strike.—TERMS OF AWARD.—It is officially announced that the Committee on Production, having on Friday last considered a claim made by the National Transport Workers' Federation to the Municipal Tramways Association, the Tramways and Light Railways Association, and the London General Omnibus Co., Ltd., for an advance in wages, decided that the men concerned, aged 18 years and over, and the grades of women, aged 18 years and over, whose terms of employment include an undertaking that they shall be paid the same rates as the grades of men whose places they have filled, should receive such advance as would give £1 a week over the pre-war rates of the grades concerned, payment to be made on the basis of a week of six days or shifts. Women aged 18 years and over not covered by the above decision are to receive an advance of 4s. a week, subject to a maximum of 20s. a week over the pre-war rates of the grades concerned. Girls, boys, and youths under 18 years are to receive such an increase in wages as will give them half the additional advances given by the Committee's award to the men or women, as the case may be, in the same undertaking. The advances are to be first payable on the pay day in the week commencing March 4th. The award does not include women to whom the provisions of the orders made by the Minister of Munitions under the Munitions of War (Amendment) Act, 1916, apply.—*Daily Telegraph.*

The arbitration award to tramway workers, announced on Saturday, will mean an advance of 8s. a week for men and 4s. a week for women in Manchester, Salford, and most Lancashire towns. In Manchester and Salford some 4,000 employés are concerned, and the additional cost to the Manchester Corporation alone will be about £53,000 per annum.

TELEGRAPH AND TELEPHONE NOTES.

Dutch Wireless Station.—It is reported that the Dutch Government has prepared a Bill to authorise expenditure for the establishment of wireless communication between Holland and the Dutch East Indies. It is expected that a period of three months will be occupied in the erection of the station in Holland, while, in the meantime, the existing station in Java will be given an increased capacity. It is said that the Gesellschaft für Drahtlöse Telegraphie "Telefunken" will superintend the work.

France.—The new wireless station recently erected by the French Naval Authorities for communication with the United States, as mentioned in our issue of December 7th, 1917, is said to be the most powerful in existence, and has already transmitted messages as far as Australia; the stations there which received them were unable to reply in like manner, but acknowledged their receipt by cable. The station was completed in six months, in time to assist in the protection of the first convoys of troops from the United States.

Direct communication between Washington and American Army Headquarters in France will be made possible with the completion of a radio station now being built in France by the Navy Department. At the close of the war the station will be taken over by the French Government. The station will cost $2,250,000.—*T. and T. Age.*

Japan.—The Japanese Department of Communications wishes to establish a large new wireless station exclusively for the benefit of the general public, which will develop the same transmission power as that at Funabashi, which belongs to the Japanese Navy. The Department has decided to erect a wireless station in the Ojika Peninsula, Akita Prefecture.—*T. and T. Age.*

Peru.—The new wireless station at Cashendo, Peru, has been opened. The station can communicate with Argentina, Chile, most parts of Brazil, Uruguay, Paraguay, and Bolivia, and has even caught signals from the United States.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Australia.—MELBOURNE.—April th. Department of the Navy. Motor-driven hydraulic pump.

June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Bolton.—March 18th. Tramways Department. Materials and stores for 12 months. See "Official Notices" March 8th.

Darlington.—March 29th. Electricity Committee. Water-tube boiler, economiser, cooling tower, fan and feed pump. See "Official Notices" to-day.

Eastbourne.—March 25th. Electricity Department. Six or twelve months' supply of pea or slack coal. See "Official Notices" to-day.

Lancaster.—March 18th. Tramways Committee. Supply of uniforms. See "Official Notices" March 8th.

Macclesfield.—March 18th. Cheshire County Asylum. Stores (10). Electrical goods for six or twelve months. Forms from W. G. F. Tingay, Parkside, Macclesfield.

Manchester.—March 27th. Electricity Committee. Supply and laying of 33,000-volt E.H.T. cable. See "Official Notices" March 8th.

CLOSED.

Bradford.—Electricity Committee. Messrs. Ferguson, Pailin & Co., Ltd. Three single-phase reactances for new turbo-generator.

Derby.—T.C. Setting boiler and economiser at the new power station. E. Morley & Sons, £492.

London.—HAMMERSMITH.—Electricity Committee:—

British Electrical Transformer Co.—Four 100-K.V.A. transformers, at £142 each, and six 200-K.V.A. transformers, at £240 each.
Park Royal Engineering Works.—Switchgear, at £27.

In view of the difficulty in obtaining tenders for the various stores and materials required by the Electricity Department, the Committee has instructed the Borough Electrical Engineer to obtain prices for supplies from time to time, such prices to be submitted to the Council.

Newport, Mon.—The Electricity and Tramways Committee recommends the acceptance of the tender of Messrs. Fraser and Chalmers for a 3,750-KW. turbo-alternator set. The alternator is to be supplied by the General Electric Co., Ltd.

Sheffield.—City Council:—

Wellerman Bros., Ltd.—Additional storey to sub-station building, £350.
Staveley Coal and Iron Co., Ltd.—Circulating water discharge pipes at emergency power station.

Stoke-on-Trent.—T.C. Repairs to engine at the Electricity Works. Davey, Paxman & Co., Ltd, £219.

Swansea.—Electricity Committee:—

New Switchgear Construction Co.—Switchgear.
Stanton Ironworks Co., Ltd.—Circulating pipework.

Wolverhampton.—Town Council:—

Callender's Cable and Construction Co., Ltd.—Cables for the 12 months in accordance with the schedule.
Aron Electricity Meter Co., Ltd.—Testing meter set, £71.
Gibbons Bros.—Reconstruction and extension of the coal conveyor plant, £1,363, plus 15 per cent. for contingencies.
The agreement with the Chloride Electrical Co., Ltd., dated December 4th, 1911, for maintenance, &c., of storage battery at the electricity works, is to be varied in accordance with the terms agreed upon by the company and the electrical engineer.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 15th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. General meeting.

Junior Institution of Engineers.—Friday, March 15th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Organisation of British Engineering Industry," by Mr. H. R. Summers.

Monday, March 18th. At 7.30 p.m. Paper on "The Mining and Metallurgy of Gold," by Mr. J. W. Wardell.

Friday, March 22nd. At 7.30 p.m. Paper on "Pyrometers and Impact Testing," by Mr. C. E. Foster.

(**Midland Section**).—Friday, March 15th. At the Imperial Hotel, Temple Street, Birmingham. At 7.45 p.m. Paper on "Power Transmission," by Mr. G. H. Ayres.

Friday, March 22nd. At 7.45 p.m. Paper on "Constructional Engineering," by Mr. G. W. Costigan.

(**North Kent Section**).—Saturday, March 16th. At the Dartford Technical Institute. At 7.30 p.m. Paper on "Local Equalisers," by Mr. R. Rankin.

Electro-Harmonic Society.—Friday, March 15th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Last Smoking Concert of the Season. Chairman: Mr. C. H. Wordingham, President of the Institution of Electrical Engineers

Institution of Post Office Electrical Engineers (London Centre).—Monday, March 18th. At 4 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "The Work of a Drawing Office," by Messrs. H. A. Miles and H. J. Mobbs.

Institution of Civil Engineers.—Tuesday, March 19th. At Gt. George Street, Westminster, S.W. At 5.30 p.m. Discussion on "Modern Developments in Gasworks Construction and Practice." Paper on "The Derwent Valley Waterworks," by Mr. E. Sandeman.

Liverpool Engineering Society.—Wednesday, March 20th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Electric Welding," by Mr. T. G. McKay.

Greenock Electrical Society.—Thursday, March 21st. At 7.45 p.m. At 22, West Stewart Street. Paper on "Production of Iron and Steel," by Mr. A. Norwell.

Belfast Association of Engineers.—Thursday, March 21st. At 7.45 p.m. At the Municipal Technical Institute. Paper on "The Panama Canal," by Mr. J. M. Barbour.

Institution of Electrical Engineers.—Thursday, March 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Mechanical Design and Specification of the Turbo-alternator Rotor," by Dr. S. F. Barclay.

(**Birmingham Local Section**).—Wednesday, March 20th. At the University. At 7 p.m. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(**Students' Section**).—Friday, March 22nd. At 7 p.m. At the City and Guilds (Engineering) College, South Kensington, S.W. Address by the President.

Royal Institution of Great Britain.—Friday, March 22nd. At Albemarle Street, W. At 5.30 p.m. Lecture on "Radiation from System of Electrons," by Prof. Sir J. J. Thomson, President R.S.

Saturday, March 23rd. At 3 p.m. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, President R.S.

NOTES.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters, Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 23rd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. C. E. Campbell.

Next for Duty.—Second Lieut. F. Gaywood.

Monday, March 18th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30, Signalling Section, 6.30—8.30.

Tuesday, March 19th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 20th.—No. 1 Company, Entrenchments, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 21st.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 22nd.—Musketry, 5.30—8.

Saturday, March 23rd.—Knotting, Lashing and Splicing for the whole corps, 2.45—4.45. Musketry, 2.45—4.45.

Special Notice.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Electric Steel at Wigan.—An important new industry for the production of high-grade steel has been started at Wigan. Councillor Alstead, chairman of the New Industries Committee of the Corporation, informed the Town Council, last week, that negotiations had now been completed, and the work would be pushed on with all speed. The new firm will be known as the Wigan Electro-Metallurgical Co., and it will use electricity for the production from British ironstone of high-grade steel, for which this country has hitherto been dependent upon Swedish and Spanish ore. Councillor Alstead said the process had passed the experimental stage, and the project had received the approval of the Treasury. A site near the electricity works will allow for great expansion, and big developments are hoped for.

The Non-Ferrous Metal Industry Act.—The President of the Board of Trade has appointed Sir Dudley S. Smith, K.C. (chairman), Sir H. Elverston, M.P., and Mr. H. I. Mackinder, M.P., as a Committee to examine all applications for licences under this Act, and to report to the Board thereon. A copy of the rules made by the Board under the Act appears in the *London Gazette* for March 8th.

Electric Vehicles in Ipswich.—Mr. Frank Ayton, chief engineer and manager of the Ipswich Corporation electric supply and tramway departments, informs us that a report has been issued by the borough surveyor of Weymouth, on certain information which he has collected from different towns as to their experience with different electric vehicles, in which, by a mistake, he refers to Ipswich as having in use a Ransomes' "Orwell"-type three-ton vehicle. The vehicle, however, is one supplied by the General Vehicle Co. before Messrs. Ransomes, Sims & Jefferies had begun to make electric vehicles. Further, in connection with the information given under Ipswich, the borough surveyor in stating that he believed that, where a journey less than 2½ to 3 miles had to be made, the advantage lay with horse haulage, intended that the 2½ to 3 miles should be the complete journey there and back—or, in other words, he considered that horse haulage had the advantage within a radius of 1¼ to 1½ miles. Mr. Ayton adds that the Ipswich Corporation is absolutely satisfied with the results that have been obtained from the vehicle in question.

An Engineering Council.—Employers and employed in the engineering trades of Manchester have formed an Engineering Council, the primary object of which is to provide facilities for personal intercourse between employers and workers and to carry out constructive investigation and study of conditions and problems affecting the industry. It is considered of first importance that the difficulties facing the engineering trade should be discussed on their merits, and not with the object of "making out a case," an attitude which seems unavoidable during negotiations. It is claimed that employers and workers have sufficient interests in common to make joint discussion fruitful, and to lead to a better understanding between both parties.—*Morning Post.*

Tramcar Conductress Complimented.—Mrs. Mabel Innes, the conductress of the tramcar which recently capsized on a dark, foggy morning on a hilly curve near Allerton, Bradford, was called before a meeting of the Corporation Tramways Committee, last week, and, after being complimented, was presented with £5 as a mark of appreciation of her behaviour during the accident and for the advice by which she doubtless saved the passengers from more serious injury than was sustained. Mrs. Innes was complimented by the Coroner and jury at the inquest on the driver.

The Neglect of Science.—Sir Alfred Keogh, on resuming the Rectorship of the Imperial College Union, South Kensington, was accorded an enthusiastic welcome by the Governors and the students. In returning thanks, he said :—"I hold and always have held that in this country, and perhaps in this country alone, administration has been absolutely divorced from science, that the administrator, as a rule, is ignorant of any particular branch of science, that he has, as a rule, no scientific training, and neither thinks nor acts scientifically. I attribute many of our national shortcomings to this fact. If I have accomplished those things which you say I have in my official service, it has been because I have from the first, both in matters of science and of administration, relied entirely upon scientific men and refused to take into my counsels other classes of administrators. To have done so would have been to have given the lie to the principles I have held for so many years."—*The Times.*

Electrical Trades Benevolent Institution.—The appeals which have been made through the electrical Press during the last few months are beginning to make themselves felt. The Electricals of Cardiff put their heads together, and on March 1st arranged a first-class concert, having unearthed latent talent amongst their members. The G.E.C., who have always liberally supported the Benevolent Institution, offered the use of their showroom for the concert to be held in. During the evening appeals were made by Mr. J. Howard Fletcher, M.I.E.E. (chairman of the Western Section of the Institution of Electrical Engineers), and Mr. Chamen, M.I.E.E., resulting in a sum of £23 being collected, promises made for other amounts, and new members joining. Cardiff has now 17 members, which is probably a record for any town outside London. We are given to understand that the Bristol electricals, who are always in friendly rivalry with Cardiff, intend arranging something on similar lines in the near future and "going one better." Will other towns please copy ?

The Electrical Theory of Matter.—Sir Oliver Lodge lectured recently at the Birmingham University on certain astronomical problems in relation to the electrical theory of matter. The chief problem dealt with was that known as the "progression of the planetary apses." Modern astronomers had long been aware that the observed progression was due to the perturbations caused in a planet's orbit by the gravitational pull of the other planets. There was a discrepancy in the case of Mercury, which amounted to about 43 seconds of arc in a century. That was the outstanding astronomical puzzle of the ages. If the electrical theory of matter was correct it was demonstrable that a body moving swiftly through the ether developed an extra or spurious momentum which was not subject to gravitational influence. It was that extra momentum, unknown to older physicists, that was the key to the solution. As the amount of the unaccounted-for progression of Mercury's apses was known, and also its orbital velocity, the formula fixed a value for the velocity in a certain direction of the solar-plus-stellar drift, which turned out to be between two and three times the earth's orbital velocity, and applying it to Mars, he got a value—seven seconds in a century—for the unaccounted-for progression of the apses in the case of that planet. When making the calculation he was not aware what the observed unaccounted-for progression in that case was. Prof. Eddington's figure coincided with the result he had theoretically obtained.—*Birmingham Daily Post.*

Coal Control.—An Advisory Committee has been formed by Mr. Guy Calthrop, Coal Controller, to represent the Public Utility Authorities of the County of London, and consists of :—

F. C. McQuown (County of London Electric Supply Co., Ltd.).
J. W. Beauchamp (West Ham Corporation E.S.).
D. Milne Watson (Gas Light and Coke Co.).
A. Stokes, (South Met. Gas Co.).
A. L. C. Fell (L.C.C. Tramways).

Inland Waterways.—On Wednesday last a conference was to be held between the County Purposes Committee of the Corporation of London and the Canal Control Committee, to consider the improved use of our inland waterways. One hundred representatives of municipal Corporations and other local authorities throughout the country were expected to attend.—*Daily Telegraph.*

Educational.—University College, London. — The annual report, which has just been issued, states that whereas in normal times the total number of students, day and evening, amounts to about 2,200, the number last session was 1,240. Whereas the normal fee revenue amounts to between £29,000 and £30,000 a year, the fee revenue last year was only £14,000. The financial position is naturally a difficult one, and it is anticipated that, unless further help from the Treasury is forthcoming, there will be a deficit at the end of the current session of nearly £9,000 on the College establishment account.

The report shows that, while the ordinary activities of the College have been maintained to meet the needs of the students actually in attendance, all available energies have been directed towards war purposes.

The Pro Patria list includes about 2,500 names of past and present members of the College who are taking an active part in one or other of the Services connected with the war. Of these 195 have already fallen. The list of honours and distinctions gained in the war is a long one.

Manchester College of Technology.—Owing to the popular use of the word "School" as an institution for the education of young people, the governing body of the School of Technology has decided to adopt the title of "College" for the well-known School of Technology, which has attained a position in the front rank of University Colleges, forms part of the University of Manchester, and includes upon its staff such distinguished engineers and scientists as Prof. G. G. Stoney, F.R.S., Prof. A. G Green, F.R.S., and Prof. Miles Walker. In the two years before the war the number of matriculated students attending the College increased by 50 per cent., and though the war has drawn away over two-thirds of its students, to-day there are actually more undergraduates than there were in 1912, and the proportion of evening students doing the most advanced work doubled between 1913 and 1916. The Government grant has increased from £11,895 in 1910-11 to £16,646 in 1915-16, and the City Council before the commencement of the war decided to carry out extensions costing £20,000. Special attention is given to research work, which at present is mainly directed to war purposes, and co-operative researches in conjunction with local industries are increasing in number.

Inquiries.—Makers of the "Ideal" ironclad switches and "Hornfibre" are asked for.

Fuel Oil Experiments.—*The Times* understands that large scale tests have been carried out by the Ministry of Munitions in the production of fuel oil by the carbonisation of cannel coal. It is stated that these tests have been very successful, and that they have shown that extraordinarily high yields of fuel oil, ammonia, and other by-products can be obtained by utilising existing gas works retorts under special conditions, which do not involve much additional outlay.

The Electrical Power Engineers' Association.—The Northern Division has now taken offices at 37, Blackfriars Street, Manchester, and in future all business will be dealt with at this address. The Division is making rapid headway, and applications for membership are being received daily from all parts of the area covered by it.

A very successful inaugural meeting of the E.P.E.A. for Leeds and district was held in the Y.M.C.A. Rooms, Albion Place, Leeds, on February 27th. Mr. C. Nelson Hefford, engineer and manager of Leeds Corporation electricity department, was in the chair. The meeting was well attended, there being present about 100 engineers from the district. After opening remarks by the chairman on the advantages of organisation, Messrs. Lunn and Holt, the chairman and assistant hon. secretary respectively of the Northern Division of the E.P.E.A., supported by Mr. Redmayne (of Sheffield) and Mr. Spurr (of Bradford) addressed the meeting on the advantages of joining the Association, and explained its objects and scope.

A resolution to the effect that the meeting should join the E.P.E.A. and form a branch for the Yorkshire area was carried unanimously. The next meeting is to be held on March 27th.

Wages Awards.—The following are among recent decisions given by the Committee on Production and the Special Arbitration Tribunal on cases which have been referred to them by the Ministry of Labour:—

Motormen and Conductors (Birmingham and Midland Tramways Joint Committee). The motormen and male conductors concerned, aged 18 and over, are to receive 16s. per week over their pre-war wages from January 1st, 1918.

Foremen, Charge Hands, and Electrotechnical Assistants (Messrs. Robert Paul, London). The men concerned, aged 18 and over, are to receive from first pay in December such further advances as will bring the increases on pre-war rates to 20s. per week.

Electricians (Metropolitan Electric Tramways, Ltd., and London United Tramways, Ltd.).—Plain time-workers are to receive a bonus of 12½ per cent., and piece-workers a bonus of 7½ per cent. on earnings from first pay after January 1st, 1918.

The Committee on Production and the Special Arbitration Tribunal have also made the following awards:—

1. London County Council Employés. Certain workmen employed in (1) the main drainage, asylums, fire brigade, and tramway services; (2) at Woolwich Ferry and the Thames Tunnels; and (3) in the chief engineer's department (electrical branch) are to receive, in the case of plain time workers, a bonus of 12½ per cent. on earnings, and in the case of piece-workers a bonus of 7½ per cent. on earnings, from the first pay week following February 15th, 1918. The bonus is not to apply to minor officials or to classes of workmen, such as building trade operatives, whose wages have customarily been regulated by movements in the wages of the trades in which workmen of the same classes are ordinarily employed.

2. Birmingham Corporation Employés. Workpeople, paid at plain time rates, in gas, water, and tramway departments (except motormen, conductors, and other employés on the traffic staff, whose case is reserved for further consideration), these departments being certified under the Munitions of War Act, 1916, are to receive a bonus of 12½ per cent. on earnings from first pay week following February 14th, 1918. The bonus does not apply to classes of workmen, such as building trade operatives, whose wages have customarily been regulated by movements in the wages of the trades in which workmen of the same classes are ordinarily employed.—*The Times*.

Fatality.—William Craig (20), belonging to Sauchie, Stirlingshire, was working an electrically-controlled capstan in Kelliebank Bottle Works, when, it is supposed, he was caught by a coil of the wire rope and thrown over the capstan, where he was subsequently found unconscious. He died a few minutes afterwards.

According to the *Sheffield Independent*, T. H. Jenkinson (47), an electrician's labourer at Messrs. Thomas Firth & Sons, Ltd., Sheffield, was found on Monday, last week, lying dead on the floor of a sub-station near some current transformers (6,000 to 7,000 volts). He had apparently touched the current coil with the handbrush he was holding. Verdict: "Accidental death."

Engineering Training in Australia.—Following on Mr. Harper's scheme, described in our issue of April 20th, 1917, Mr. Guy Allbut, electrical engineer and manager of the Newcastle, N.S.W., municipal electrical undertaking, is taking steps to raise the standard of efficiency of the technical branch of the electric supply department, and to help towards providing better trained men for the future. He has recommended: (*a*) A system of apprenticeship providing for technical training; (*b*) a system of scholarship whereby those boys who respond to the technical and practical training shall be able to gain experience in one or other of the workshops of the best British and American electrical manufacturers.—*Commonwealth Engineer*.

A New Fuel for Motors.—The Paris *Auto* announces the discovery of a new combustible which contains neither petrol, coal gas, nor alcohol, experiments with which have given very favourable results. The new fuel is secured by the distillation of the heavy oils obtained from the chemical distillation of coal, the process being carried out in such a way that all the by-products from its manufacture become available for the preparation of nitro-explosives. It is claimed for the new fuel that it does not foul the cylinders or leave a residue of carbon, and the consumption is stated to be less than that of petrol.

The Sulphuric Acid and Fertiliser Trades.—In the *Board of Trade Journal* for March 7th, the report of the Departmental Committee appointed by the Minister of Munitions to consider the position of the sulphuric acid and fertiliser trades, as affected by the new acid plants which have been erected by the Ministry, is printed. It states that the productive capacity of the country has reached a value far in excess of the pre-war consumption, and this has created a post-war problem of considerable difficulty. The output is likely to be further increased by the smelting in this country of Australian zinc concentrates, which formerly went to Continental works.

The Committee has come to the conclusion that the most promising method of utilising the surplus acid is the manufacture of artificial fertilisers, especially superphosphates, and advocates the adoption of a vigorous agricultural policy in relation to the efficient cultivation of the soil, with an increased use of fertilisers. The formation of a National Association of Sulphuric Acid Manufacturers is recommended, as well as the scrapping of inefficient plant, for which compensation should be paid out of public funds.

Institution and Lecture Notes.—Institution of Electrical Engineers.—A Committee was appointed by the Council, on December 13th, 1917, to consider the question of the supply and prices of fuel oils to electricity supply undertakings, and a deputation from the Committee interviewed the Controller of Munitions Mineral Oil Production, with highly satisfactory results. A Committee of the Diesel Engine Users' Association was formed, on which the Institution is represented by Messrs. A. H. Dykes, W. Fennell, and J. C. Wigham. The Controller also addressed a letter to users of Diesel engines, advising the adoption of tar oils under licence from the Department, and offering to assist in adapting the engines for this purpose by obtaining priority for the alterations.

A panel of the B.E.S. Sub-Committee on Nomenclature has been formed to draft a list of terms and definitions used in connection with automatic telephones, under the chairmanship of Mr. A. P. Trotter.

The annual meeting of the Western Local Section was held on Monday last. In the absence of Mr. R. Howard Fletcher, Mr. H. I. Rogers presided, and a resolution of condolence with the relatives of the late Mr. Duddell was passed. Mr. E. Basil Wedmore then read his paper on "The Control of Large Amounts of Power," and a discussion followed. The following gentlemen were elected on the Committee for the ensuing session:—Messrs. H. I. Rogers (chairman), A. Ellis (vice-chairman), J. G. Eastwood, W. T. Kerr, A. Nicholls Moore, T. E. Lewis, and I. A. D. Pedler. Messrs. A. J. Newman and C. T. Allan were elected joint hon. secretaries, and Mr. A. J. Newman, hon. treasurer.

The Rontgen Society.—This Society has recently founded an annual lecture in memory of its first president, the late Prof. Silvanus P. Thompson. The first lecture will be delivered by Prof. Sir Ernest Rutherford, F.R.S., at the next meeting of the Society, on Tuesday, April 9th, at 8 p.m. The Council will be pleased to welcome all interested, and applications for cards of admission should be made to the hon. secretary, Dr. S. Russ, Middlesex Hospital, London, W. 1.

At a meeting of the Bradford Textile Society, on Monday evening, Dr. J. F. Crowley, M.I.E.E., was to have lectured on "Some Interesting Applications of Electricity in the Textile Factory," but in view of circumstances arising since the syllabus was arranged, he changed the subject to "Economic Aspects of Industrial Unrest."

Royal Society of Arts.—The paper on "Agricultural Machinery," by Mr. F. S. Courtney, announced for reading before the Society on the 20th inst., has been postponed till April 17th. On Wednesday, March 20th, a paper on "The Food Situation in Germany" will be read by Mr. Percy Shuttlewood, of the Ministry of Food.

To One-Man Business Proprietors.—An Association has recently been formed of those who come under the above-mentioned heading, its objects being to look after the interests of its members both during and after the war. The Association has received the official recognition of the Ministry of National Service. Practically every trade and profession is represented amongst its members. Those interested should apply to the Honorary Secretary, "One-Man Business Association," c/o The Holborn Restaurant, London, W. 1, who will be pleased to forward all particulars regarding the Association.

National Electricity Supply.—We have received from Mr. Andrew Gemmell, "a shareholder and a former secretary of electric power companies," a pamphlet on the reference to the North of England in the Report of the Sub-Committee on Coal Conservation, in which the author argues that the Report is in error in attributing to company ownership lower charges for energy than in the case of municipal control, and adversely criticises the methods of commercial and financial organisation adopted by the companies forming the North-Eastern combination. In particular, he comments on the history of the Cleveland group of companies, the absence of an audit of the business as a whole, and the alleged success of the Waste Heat Co., with regard to the reduction of charges for electric power supply that is called for in the interests of the nation.

On Tuesday last week a debate took place at the Engineers' Club, Manchester, on the Interim Report of the Coal Conservation Sub-Committee on Electric Power Supply. Mr. George Hughes presided, and Mr. S. L. Pearce, chief electrical engineer to the Manchester Corporation, was the principal speaker. A report will appear in our next issue.

Appointments Vacant.—Instructor in electrical engineering and wiring in connection with the training of discharged and disabled sailors and soldiers, for the Barnsley Corporation Electricity Committee: electrical fitters and armature winders, for the Newport Corporation Electricity and Tramways Department; assistant working electrical engineer (55s. + 15 per cent.), for the Ormskirk B. of G.; mains and meter man (50s. + 12½ per cent.), for the Wishaw Burgh Electricity Department; shift engineer (£170) for the Wolverhampton Corporation Electricity Department; charge engineer (£143 + 12½ per cent.) for the Weymouth Corporation Electricity Works; junior shift engineer (£130) for the Borough of Dover Electricity Works; meter superintendent (52s. 6d.) for Loughborough Corporation Electricity Department. See our advertisement pages to-day.

Electrical Cooking.—Mr. William A. Gillott, of the Newcastle Electric Supply Co., Ltd., addressed the members of the Newcastle Rotary Club, last week, on the subject of electrical cooking. He said that from 35,000 to 40,000 meals per week were prepared in Newcastle by electrical apparatus, and schemes were in hand for dealing with 200,000 meals per week. He did not think that, four years ago, there were 500 meals so prepared. Electric cooking was, therefore, a commercial proposition. Speaking of cost, he said that in canteens four or five meals could be cooked at the cost of a penny. He could say, without giving any secrets away, that a certain firm of caterers in the city were shaking hands with themselves over the saving effected by the use of electrical cooking apparatus.—*Newcastle Chronicle.*

Overseas Trade of the Future.—In our leaderette of last week, p. 218, in the course of printers' corrections, a line was accidentally omitted. From line 25 (second column) onwards should read thus:—

"When the new system comes into force the more promising Consuls will be eligible as Commercial Attachés after passing through specified progressive grades. It will be the work of the Commercial Attachés to collect information," and so on.

Babcock & Wilcox in Spain.—The *Times* Madrid correspondent states that an agreement has been concluded between Messrs. Babcock & Wilcox and a group of influential Bilbao capitalists for the establishment of engineering works in that city, which will be by far the largest of their kind in Spain. A company has been formed, entitled the Sociedad Espanola de Construcciones Babcock & Wilcox. It has been formed under the new Spanish law for the stimulation of national industry, by which the Government guarantees payment of 5 per cent. interest on the capital paid up should the net profits of the company fall below that percentage. The capital has been fixed at 24 million pesetas, approximately 1 million sterling, and 20 millions have been issued and subscribed. The object of the company will be to manufacture Babcock & Wilcox marine boilers and engines for vessels built in Spain, stationary and other boilers, electric cranes and conveying machines, drawn steel tubes, and also locomotives of the type used in Spain and Portugal, which formerly were all brought from Germany. The works of the company will cover about 30 acres, and will give employment to about 2,500 men.

The B.E.A.M.A.—The annual general meeting of the British Electrical and Allied Manufacturers' Association was held on February 28th. The report for the year ended September 30th, 1917, was adopted. On ballot the following were elected to fill the five vacancies on the Council:—British Electric Transformer Co., Ltd.; Browett, Lindley & Co., Ltd.; Mather & Platt, Ltd.; C. A. Parsons & Co., Ltd.; and Yates & Thom, Ltd. The chairman mentioned in the course of his remarks that the articles of association had been entirely recast, and the B.E.A.M.A. was now an Association for Manufacturers exclusively, the classes of "Associate Member" and "Associate," consisting chiefly of factors, having been cut out. We shall refer more fully to the report and meeting in our next issue.

Street Lighting Specifications.—The Standard Clauses for Street Lighting Specifications recommended in the Majority Report of the Street Lighting Specification Committee (see *Journal* I.E.E., 1917, Vol. LV, page 522) have been published in pamphlet form. Copies can be obtained from the Secretary of the Institution, price 3d. each, or 4d. post-free.

Electricity and Agriculture.—Writing to *The Times*, Dr. Chas. Mercier states that while the electrification of growing crops is "in the experimental stage," the electrification of seed before sowing has been proved to be highly beneficial; farmers who tried the process on a small scale have successively increased their operations, and this year hundreds of acres in the county of Dorset are being sown with electrified seed.

Prof. Henry Armstrong and Dr. J. Crichton-Browne have written questioning the facts and deprecating the use of electrical treatment on a commercial scale until its efficacy has been demonstrated and the "effects have been accurately defined and gauged." We have not heard that the Admiralty have deferred the use of new inventions for the solution of the submarine problem until their effects have been accurately measured to the satisfaction of the professors, who seem to leave the emergencies of war-time out of their calculations. Now is the time to act, and to adopt every possible device which offers any prospect of increasing our supply of food; there will be plenty of time for accurate measurement when we have attained the victory which is essential to our existence as an Empire, or even a free nation. We are glad to see that Prof. Sir Oliver Lodge, in a letter to *The Times*, declares that the use of the electric discharge over growing crops passed the laboratory stage some time ago, and "has given practical results for some years."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—At a special private meeting of the York City Council, at which proposed increases of salaries to officials in all departments were discussed at length, it was decided that the increases in respect of the salaries of the engineers in the electricity department, who recently received a £50 advance, be referred back to the Electricity Committee to consider in conjunction with the proposed increases of the Askwith award, standing orders to be suspended to enable the question to be dealt with at a later Council meeting. The application of the Askwith award to the city electrical engineer was referred back for further information. It was resolved to increase the salary of the draughtsman in the electricity department by £10 to £140, and for several clerical assistants advances of £5, £3, and thereabouts were approved.

The Hove Lighting Committee has resolved to advance the salary of Mr. C. B. Smith, the electrical engineer, by £100 per annum. Mr. Smith has acted as engineer since the inception of the old company in 1892, and was retained by the Corporation when it took over the undertaking in 1914 as engineer at the same salary as that paid him by the company, viz., £650 per annum.

Lieutenant R. L. Acland has been gazetted Major Commanding the Derbyshire Motor Volunteer Corps. Major Acland is borough electrical engineer and tramways manager, Chesterfield.

The technical engineering staff of the Dublin Corporation electrical department presented Mr. J. J. O'Neill with an illuminated address and a gold watch in appreciation of his work as chairman of the Electricity Supply Committee during the past four years. Mr. L. J. Kettle, deputy city electrical engineer, who performed the ceremony, said it was no easy matter to reconcile the multiplicity of interests involved in the huge electrical undertaking and to do justice to the staff and the enterprise, but Mr. O'Neill could fairly claim to have achieved success. Mr. O'Neill, in acknowledgment, spoke of the good relationship which had been maintained between the Committee and the staff, and expressed his belief that in the near future the electrical undertaking would be one of Dublin's greatest assets, and that before many years faultfinding would have to make way for honest appreciation of what had been done, and was being done, on behalf of the citizens.

Mr. Herbert Pollard, engineer-in-charge to the Rochdale Corporation electricity department, has been appointed engineer-in-charge to the Keighley Corporation.

At the Plymouth T.C. it was reported that Mr. Everson's appointment as tramways manager would expire on August 8th, and it was decided that the appointment be continued until November 8th, 1919, at £600 per annum and house.

The salary of Mr. R. H. Campion, eletcrical engineer to the Dewsbury Corporation, has been advanced by £25 per year. The salary of the assistant engineer has been advanced £20, and the Electricity Committee has resolved that the award of 12½ per cent. bonus on earnings shall apply to all employés at the works who have received the full bonus awards up to date.

At a meeting of the Bolton T.C., last week, it was decided to increase the salary of the electrical engineer, Mr. W. J. Wood, from £600 to £800 per annum. It was stated that Mr. Wood had spent £125,000 on improvements at the Back-o'-th'-Bank generating station, and had asked for no special assistance.

Dover T.C. has appointed Mr. Harpur, mains superintendent, to succeed Mr. Woodman as electrical engineer, at a salary of £300 a year and house, and Mr. Smith, works superintendent, as chief assistant electrical engineer at £275 a year.

Mr. G. Roddy, traffic manager of the Rhondda Tramways, having been appointed Divisional Inspector for South Wales and Monmouthshire under the Ministry of Food, is to receive a presentation from his friends at Porth on March 22nd.

Presentations have been made to Mr. Albert Mackrill, chief clerk in the Hull tramways electrical engineer's office. He is leaving Hull after 18 years' service with the Corporation to take up an appointment at Stoke-on-Trent as commercial manager to the borough electrical engineer. He was presented with a portion of a silver dinner service by Mr. Wilkinson, subscribed for by the employés. Mr. Elliott, chief mechanical engineer, and Mr. Bruce, chief assistant engineer, followed with appropriate remarks, and Mr. Mackrill responded. As a personal token of appreciation, Mr. Wilkinson handed Mr. Mackrill a gold English lever watch.

Exeter City Council, on Tuesday, approved the Electricity Committee's recommendation to advance the salary of the electrical engineer, Mr. H. D. Munro, from £475 to £550.

General.—Mr. C. H. WORDINGHAM, M.Inst.C.E., whose official title under the Admiralty has hitherto been Superintending Electrical Engineer, will in future be known as Director of Electrical Engineering, and his department will no longer be attached to that of the Director of Naval Construction, but be entirely separate and self-contained.

Mr. H. A. VERNET, who has been appointed Paper Controller, is a director of the Underground Electric Railways Co. and the Metropolitan District Railway, and is also chairman of the Traction & Power Securities Co.

Monsieur J. A. MONTPELLIER, who for many years was editor of our contemporary *l'Electricien*, which in August, 1914, suspended operations for the period of the war, has become editor of *l'Industrie Electrique* as from March 1st. M. Montpellier has rendered important services in connection with the Military Telegraph Service at Paris during the war. He has the best wishes of his electrical and journalistic confrères in this country on his return to the editorial chair.

Mr. HAROLD W. SMITH, electrical engineer with the Australian Commonwealth Department of Works and Railways, has accepted a position with the Westinghouse Co., Pittsburg, U.S.A. Mr. R. C. CREASEY has been appointed engineer-in-charge of the Corowa, N.S.W., municipal electric supply.—*Commonwealth Engineer.*

Mr. SYDNEY DICKS, late senior representative of the Union Cable Co., Ltd., of Dagenham, has now joined the Enterprise Manufacturing Co., Ltd., as a director.

Mr. HOWARD FOULDS, secretary of Callender's Cable and Construction Co., Ltd., and other companies, has been elected a member of the Council of the Chartered Institute of Secretaries.

The marriage took place yesterday, at Bath, of Lieutenant CHRISTOPHER WADE, M.T., A.S.C., youngest son of the late Mr. J. E. Wade, of Brantingham Thorpe, and the late Mrs. Wade, of Kirkella Hall, East Yorks, and Alice Dorothea Evelyn, younger daughter of the late Major-General Henry Evelyn Coningham, Madras Staff Corps, and Mrs. Coningham, of Sydney Place, Bath.

Roll of Honour.—Lieutenant A. M'AUSLAN, R.F.A., formerly on the staff of the electrical department at Messrs. Harland & Wolff's shipyard at Irvine, has been awarded the Military Cross.

Lance-Corporal A. GUNN, of Polmadie, Scotland, formerly in charge of the electric power station at Aitkenhead Colliery, Mount Florida, has been awarded the Military Medal.

Private H. FEATHERSTON, of the King's (Liverpool Regiment), killed in action, was employed by the British Westinghouse Co. at Trafford Park.

Artificer W. HOWARTH, an electrician who lost his life on board a vessel which was recently torpedoed, was employed by Messrs. Richard Haworth & Sons, Ltd., Salford.

Lance-Corporal G. ALLEN, Loyal North Lancashire Regiment, previously posted missing, now reported killed, aged 24, was an electrical engineer with Messrs. Heywoods, Ltd., Manchester.

Driver J. W. SEDDON, R.F.A., who has died from wounds, was an employé of the Lancashire Dynamo & Motor Co., Ltd., Trafford Park.

Gunner H. SAVAGE, R.E., awarded the Military Medal for gallantry in the field by mending wire under heavy shell fire, was a former employé of Messrs. Dick, Kerr & Co., Ltd., Preston.

Second-Lieutenant J. R. BECKTON, R.E., who has fallen in action, aged 28 years, was on the staff of Messrs. Crompton and Co., Ltd., of Chelmsford.

Captain FRANK HILEY, Yorkshire Regiment, who has been accidentally killed in Italy, aged 23 years, was an electrical engineer at Hemsworth Colliery.

Obituary.—MR. R. W. HORNSBY.—The *Times* contains a notice to the effect that Mr. Richard William Hornsby, late of St. Vincent's, Grantham, passed away on March 7th at 71, Queen's Gate, after a long illness.

CITY NOTES.

Westminster Electric Supply Corpn., Ltd. Mr. J. BROWNE MARTIN presided at the annual meeting on February 27th. He said that the receipts for 1917 were in excess of those for 1916, owing mainly to the power and heating units having increased by 3,750,000. For the first time in their history current used for these purposes exceeded that for lighting. Costs of generation compared very favourably with the previous year. The difficulty of obtaining new machinery was one which, even after the war, would continue for some time. This had prevented them from shutting down two of their older stations, containing old and inefficient machines, as they would have done under different circumstances. The tendency was for coal to rise still higher in price. It had cost £12,000 more than in 1916, and they consumed 7,100 more tons. Increased wages and war bonuses bore materially upon production costs, and it was impossible to forecast the future in this connection. Costs of distribution continued to increase, owing mainly to cost of materials. Several Government Committees had been inquiring into "after the war" conditions, and the subjects discussed included the supply of electricity. So far, no practical conclusions had been arrived at. They had an increase of 0.15d. per unit in current supplied for power and heating, but lighting current remained as in 1916 (10 per cent. above pre-war rates). Captain E. I. Bax said that owing to the restricted allowances of coal to householders, they had been almost inundated by demands for heating, and had not been able to supply everybody who had asked for it owing to the difficulties attending new services, and to their feeling obliged to keep in reserve sufficient machinery to supply the great calls for all the new Government offices that were growing up all around them. Their consumers now included about 2,300 who among them were using about 6,000 electric fires. There would be an enormous extension in this department when normal conditions prevailed.

Metropolitan Electric Supply Co., Ltd. Mr. A. W. TAIT, presiding at the annual meeting on Monday, said that the satisfactory increase of 15 per cent. in gross revenue was partly accounted for by the increased charges to consumers, and the greater part of it related to power supply. Progress in the western area, which contained their largest power consumers, had been satisfactory, and only limited by the capacity of the plant and mains. The Government informed the supply companies that the Ministry of Munitions' 12½ per cent. award did not apply to their electrical workers, but a strike was threatened, and Sir George Askwith held arbitration proceedings, with the result that he granted the 12½ per cent. to all men in the employment of the London companies as from October, 1917, and, in addition, a further 5s. per week was made applicable to them in consequence of pressure put upon the companies. Their case could not be properly submitted, as they were not invited to attend until after the proceedings had commenced. The retrospective charge was imposed notwithstanding that it was pointed out that it was impossible for the companies to recover any portion of the same from their consumers until some time had elapsed. The accounts, therefore, had suffered to the extent to which these charges had to be met up to December last. To their company it meant not less than £10,000 per annum, apart from increases to the staff. It would be necessary to make some further adjustment of charges to consumers in order to recover a portion of the additional cost. The directors were pleased to be able to recommend an increase in the dividend, especially as it was accompanied by a substantial increase in the amount set aside to the depreciation and reserve fund. He hoped that when the war was over, if not before, the electricity supply companies would seriously consider some plan of amalgamation of interests. The salvation of the situation, and the proper development of supply in London, lay in that direction.

County of London Electric Supply Co., Ltd.—Capital expended on account of the company's London districts during 1917 was £45,124. Revenue, after deducting expenses, was £153,496, plus £18,378 brought forward. Debenture and loan interest absorb £43,476, £50,000 is put to reserve for depreciation, and after paying the preference dividend, and 7 per cent., less tax, on the ordinary shares for the year, £15,023 is to be carried forward. Applications received during the year were 4,551 KW., making the total 69,132 KW. Units sold were 37,595,261, an increase of 2,565,399. Consumers increased from 26,994 to 27,998. In view of cost of coal, wages, and material, and the abnormal conditions, the results are satisfactory. Coatbridge & Airdrie Electric Supply Co., Ltd., made further progress, units sold increasing from 8,414,823 to 10,072,535.

Callender's Cable & Construction Co., Ltd.—The directors propose to issue to the ordinary shareholders a new ordinary share in addition to each share held, and to subdivide both the preference and ordinary shares (£5 each) into denominations of £1 each. In order to do this the authorised share capital is to be raised from £500,000 to £700,000. After providing for the distribution as above, £150,000 in share capital will remain unissued. Treasury consent is being sought. The directors propose the foregoing course as a measure for bringing the nominal issued capital more into accord with the actual funds invested in the business. A surplus has been accumulated, apart from the reserve, which exceeds the total issued ordinary share capital.

Direct Spanish Telegraph Co., Ltd.—Dividends for the half-year ended December at the rate of 10 per cent. per annum, less tax, on the preference shares, and at the rate of 6 per cent. per annum, free of tax, on the ordinary, making 5 per cent. for the year, also a bonus of 2 per cent., free of tax, on the ordinary.

Charing Cross & City Electricity Supply Co., Ltd.—The net earnings of the West-End undertaking fell from £71,642 in 1916 to £61,869 in 1917. Dividend on the ordinary shares, 4 per cent. for the year. The net earnings of the City undertaking fell from £65,555 to £65,388.

Western Telegraph Co., Ltd.—Quarterly dividend, 3s. per share, free of tax.

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. on the common stock for March quarter.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Connections increased during 1917 by 14,329 H.P. to 297,079 H.P. Profit, exclusive of renewals or plant improvements, was £309,779, against £263,957 for 1916. £60,000 (as against £39,691) is deducted for reserve for plant renewals and improvements. Debenture and loan interest amounts to £60,606, and there is transferred to reserve for special depreciation and contingencies other than the equalisation of dividends £60,000. After paying 5 per cent. on the preference shares and 8 per cent. on the ordinary, £8,468 is to be carried forward. The general reserve account has been amalgamated with the reserve for depreciation, and is known as "Reserve for Special Depreciation and Contingencies other than the equalisation of dividends." A new account has also been opened under the head of "Reserve for plant renewals and improvements." The reasons for these changes are to be given at the annual meeting on March 21st. The additional capital expenditure for 1917 was £202,647, representing further extensions at Carville and Dunston power stations, and of mains, &c. In order to be in a position to meet further developments, when necessary, it is desirable that the preference and ordinary capital should be increased to £1,500,000 respectively. The matter will be submitted at an extraordinary general meeting on 21st inst. Mr. H. W. F. Bolckow has been appointed a director.

Northampton Electric Light & Power Co., Ltd.—At the annual meeting, on March 7th, Mr. F. H. Thornton said that the chief feature of the year had been the gradual erection of the new riverside generating station. Owing to difficulties which war conditions placed in the way of obtaining material, especially steel and iron, progress had not been so great as had been hoped for, but where a year ago there were only the foundations, there was now a very substantially-built works, which it was expected would be available in the autumn of this year. More than two miles of high-tension mains had been laid during the year; units sold had increased 11 per cent., and revenue from the sale of current 25 per cent.; while the depreciation account had been increased by £6,450. The cost of coal was £3,858 more than last year, and in this connection Mr. Thornton commented on the action of the Government in making the 2s. 6d. extra per ton imposed in October retrospective over the preceding month. That cost the company £1,000, which they were unable to recover, and the conduct of the Government was most unbusinesslike. A dividend of 8 per cent. for the half-year on the ordinary shares, making 6½ per cent. for the year, was approved.

City of London Electric Lighting Co., Ltd.—Capital expenditure during 1917, £5,839. Written off in respect of buildings, plant, and other works dismantled during 1917, £29,372. Revenue for the year £351,186, expenses £209,525, leaving £141,661, plus £17,132 brought forward. Interest on loans and debenture stock £27,241, reserve £50,000, preference dividend 6 per cent., ordinary dividend 8 per cent., carry-forward £17,573. The gross revenue increased by £18,250 to £351,186, and the net revenue by £7,861 to £141,640. The average price obtained per unit sold rose from 2.51d. to 2.61d. Consumers increased by 42 to 14,658, and KW. connected by 1,748 to 49,079. Units generated increased from 33,758,872 to 35,375,929; units sold from 28,982,456 to 29,697,392; total maximum supply demanded rose from 19,198 KW. to 20,910 KW. Power units sold 11,416,597; heating units sold 4,433,031; together 55.37 per cent. of the total sold for private supply. Annual meeting: March 20th.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—The number of houses and shops increased during 1917 by 40 to 5,110, and the equivalent of 30-watt lamps added was 35,449, making 557,624 (16,728 KW.). The units sold increased by 494,522 (10.5 per cent.). The net profit was £13,225, plus £205 brought forward. After paying the preference dividends, and 7 per cent. for the year on the ordinary shares, £580 is to be carried forward. The renewal and reserve account now stands at £141,425. It is proposed to grant an annuity of £100 per annum during his life to a gentleman who has served the company for many years, but is now entirely incapacitated by illness. Meeting: March 21st.

Rushden & District Electric Supply Co., Ltd.—Mr. F. H. Thornton, chairman, said at the annual meeting that the real difficulty of the year had been to obtain fuel and other materials. The cost of fuel had increased by 56 per cent., and this had necessitated increased charges for current. A good many people were asking the company to make extensions, and as soon as they could obtain the permission of the Ministry of Munitions they would do their best to meet the requests, as they anticipated a successful future at Rushden.

Oxford Electric Co., Ltd.—Sir Henry Mance, presiding at the annual meeting last week, referred to the loss of revenue from which the company suffered owing to the continued restriction of public lighting and shop lighting. Canvassing in new districts was practically useless, as it was impossible to obtain a permit for the necessary materials. Should they—he did not think they would—come within the scope of a national electric supply scheme after the war, there was no reason why it should not benefit the company as well as the public.

Bournemouth & Poole Electricity Supply Co., Ltd.—Including £2,265 brought forward, the available balance, after paying expenses, is £38,120. Debenture and other interest, &c., require £10,885, and £8,000 is put to depreciation reserve. After paying the preference dividends, and 6 per cent. on the ordinary, less tax, £2,079 is to be carried forward. Applications received amounted to 12,171 KW., an increase of 712 KW. Units sold for all purposes were 4,834,988. Annual meeting held yesterday, in London.

Stewarts & Lloyds, Ltd.—Dividend on the preferred ordinary shares for the past half-year at the rate of 10 per cent. per annum; 2s. per share and a bonus of 6d. per share on the deferred ordinary; £100,000 for depreciation and excess profits duty; £100,000 to reserve; £20,000 to employés' benefit reserve; carried forward £100,000.

Melton Mowbray Electric Light Co., Ltd.—Revenue for 1917, including £395 brought forward, £2,350. Dividend on the ordinary shares, 2 per cent. per annum; debenture interest, £955; reserve for renewals, £800; carry forward, £195. At the annual meeting, Mr. W. J. New said that the profits had been affected by increased cost all round. Charges to consumers had been raised.

W. T. Glover & Co., Ltd.—Dividend on ordinary shares for 1917, 5 per cent., and a bonus of 2½ per cent. Debenture redemption £6,500, reserve £20,000, carrying forward, subject to excess profits duty, £10,770.

STOCKS AND SHARES.

Tuesday Evening.

The effect of the intensified War Bond campaign has not yet entirely spent itself in the Stock Exchange markets. Business continues to go quietly, and it is evident that a good deal of the stock which was turned out last week to provide the wherewithal to buy War Bonds and War Savings Certificates, has yet to find permanent homes. So long as this influence is apparent, there is not likely to be any marked revival in Stock Exchange business, but that there is a good deal of money about in the provinces the buying orders from the various centres, especially those of Scotland, South Wales, and Yorkshire, amply witness. The purely investment markets are those most nearly affected by the aftermath of the War Bond campaign, and some people ask whether the latter, successful though it was, has provided sufficient money for the war to carry on without recourse to further borrowing in addition to the present War Bonds. Industrials continue to absorb most of the public's attention, while a certain amount of speculative interest has revived in base-metal shares.

The meeting of the Underground Electric Railways Co. passed off last Friday without particular incident, and those who went there in the expectation of a breeze came away somewhat disappointed. The chairman dwelt upon the various difficulties with which the company is faced, but added little new to the general stock of information, probably because there was little new to add. A revision of fares is now generally looked for, while those who have the good fortune to be workmen or season-ticket holders (or both) can afford to smile at the prospect of continuing to travel afoot in the company's trains, and at the present scale of charges. Metropolitan ordinary stock has weakened to 21, Districts are dull at 14½, but Underground incomes rallied to 80, and the 6 per cent. income debenture stock to 100½ xd.

The County of London Electric Supply report makes satisfactory reading to the shareholders. A dividend at the rate of 9 per cent., making 7 per cent. for the year, is declared, this being at the same rate as last year's. The total number of units sold showed an increase of 2½ millions, and there were about 1,000 extra consumers. No change has occurred in the price. City Lights, however, are ⅛ down, and Charing Cross weakened to 3¾, although the preference at 3½ are 5s. to the good.

The Kensington & Knightsbridge Electric accounts show an increase in the net profits of £16,000, which is sufficient to raise the dividend from 6 per cent. to 7 per cent., the carry-forward being slightly increased at the same time. These results, in conjunction with those upon which we commented last week, have had little effect on the market for the time, but they are likely to prove more potent when the investor's attention turns again to this department. At present, he is occupied with other matters, and, therefore, ignores the ample yields afforded by electric lighting shares, though it is necessary to hasten to add that his scope is limited in consequence of the shortage of shares on offer in the market.

Metropolitan Electric Ordinary have risen 5s. to 3¼ in consequence of the dividend being raised from 3 per cent to 4 per cent. At the meeting the other day, the chairman said he hoped that when the war was over, if it was impossible to do so before then, the electric supply companies would seriously consider some plan of amalgamation of interests. He was more than ever convinced that the salvation of the situation, and the proper development of the supply of electricity within the London area, lay in that direction.

The telegraph market is steady, and Westerns at 15⅝ are 7s. 6d. up, although, on the other hand, Eastern Ordinary at 151½ has shed a point. There is not much doing in this section. Marconis have come in for more attention than usual, and the price of the parent shares in consequence improved ⅛ to 3 3/16, while the preference advanced to 2 11/16. American Marconis are also better at 25s. Oriental Telephones at 4 5/16 have recovered 1/16.

The big rises recently secured by Callender's and Henley's have brought in a few sellers, with the result that Callenders at 17¼ and Henleys at 19½ are 5s. and 10s. lower respectively. Business marked early this week in Callenders at 17½. General Electrics have changed hands lately at 19¾ and 19 9/16, a transaction being marked in the preference at 10⅝, the middle price. India-Rubber shares keep consistently firm, and on top of their previous improvements show a further rise of 12s. 6d. at 15⅝, shares changing hands on Monday at 15¼. Babcock & Wilcox rose 3/16 to 3½ on the expectation of a bonus being declared with the next dividend, and other shares of the engineering, iron, and steel groups are generally strong. The electric manufacturing shares are just steady, activity having died down to some extent, although prices are well maintained.

The course of the rubber market runs mostly on the downward grade. The imminence of the Budget affords another reason for dulness in this section, on account of the fear that the Excess Profits Tax may be advanced. Amongst the base-metal groups, tin shares make the best showing, although there is a fairly brisk demand for those of the iron and steel companies. The armament market is somewhat irregular in tendency.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1915.	Dividend 1916.	Price March 12, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	9	6½	—	£6 18 [illegible]
Charing Cross Ordinary ..	5	5	9¾	— ¼	6 13 4
do. do. do. 4½ Pref..	4½	4½	3¼	+ ¼	6 18 6
Chelsea	4	8	3	—	5 4 4
City of London	8	8	12⅞	— ⅛	6 4 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 6 0
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	5⅝	—	6 10 3
London Electric	8	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅛	—	8 0 0
Metropolitan	8	8	8½	+ ¼	5 14 [illegible]
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	8	7⅛	—	6 6 4
South London	5	6	9	—	6 13 [illegible]
South Metropolitan Pref. ..	7	7	21/	—	6 13 [illegible]
Westminster Ordinary	7	7	6¾	—	6 18 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	83/6	1½	52½	—	6 13 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	5	7	9½	—	*7 11 4
Eastern Extension	8	8	15¼	—	*5 6 0
Eastern Tel. Ord.	8	8	151½	—1	*5 5 7
Globe Tel. and T. Ord.	7	7	14¼	—	*4 18 3
do. Pref. ..	6	6	10⅛	—	5 18 6
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	10	15	3 3/16	+ ⅛	4 14 3
Oriental Telephone Ord. ..	10	10	4 5/16	+ 1/16	2 17 3
United R. Plate Tel.	8	8	6 13/16	—	*5 17 4
West India and Pan.	6d.	6d.	1⅛	—	*2 19 2
Western Telegraph	7	8	15⅝	+ ¾	*5 2 5
HOME RAILS.					
Central London, Ord. Assented	4	4	62½	—	6 9 1
Metropolitan	1	1	21	—	4 15 8
do. District	Nil	Nil	14½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	80	+ ½	*5 0 0
FOREIGN TRAMS, &c.	**Dividend 1915.**	**Dividend 1916**			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66½	—	7 10 6
Brazil Tractions	4	4	44½	— ½	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	53	—	9 8 8
do. do. Preferred	Nil	Nil	31½	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	60	—	7 1 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	82½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	38	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3½	+ 3/16	4 5 9
British Aluminium Ord. ..	7	10	1⅝	—	6 0 9
British Insulated Ord.	17½	20	8¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	—	5 2 0
Callenders	20	20	17¼	— ¼	5 16 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 3/16	—	5 12 2
Edison Swan, fully paid ..	—	—	2⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	—	6 0 0
Gen. Elec. Pref.	6	6	10⅝	—	5 15 8
do. Ord.	10	10	19½	—	5 2 7
Henley	25	25	19½	— ½	6 8 2
do. 4½ Pref.	4½	4½	3½	—	6 12 2
India-Rubber	10	10	15⅝	+ ⅝	*6 8 0
Telegraph Con.	20	20	43	—	*5 11 9

* Dividend paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 13th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£72	..
a Bisulphide of Carbon	"	£29	..
a Borax	"	£38	..
a Copper Sulphate	"	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£23 10/-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/-	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn) ..	"	1/7 to 1/7½	..
g " Bars (best selected) ..	per ton	£147	..
g " Sheet	"	£147	..
g " Rod	"	£147	..
d " (Electrolytic) Bars ..	"	£125	..
d " " Sheets ..	"	£152	..
d " " Wire Rods	"	£133	..
d " " H.C. Wire	per lb.	1/3⅞	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/7¾	½d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large ..	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/2	1d. inc.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	r W. F. Dennis & Co.

The Value of Electric Power in Relieving Coal Shortage. Now that the question of coal shortage in the U.S.A. has been brought so prominently to the attention of the public by the recent closing order of the Fuel Administrator, it is interesting to note the splendid work that is being done and the savings effected by the railroads that have adopted electricity as a motive power on a part of their lines.

On the Elkhorn grade electrification of the Norfolk and Western Railway, which is one of the biggest coal-carrying roads in the country, the 270-ton Baldwin-Westinghouse electric locomotives haul a 3,250-ton train of steel cars loaded with coal, en route for eastern points. Previously to the electrification it required three of the biggest modern type of Mallet locomotives equipped with mechanical stokers to haul a train of this tonnage up the Elkhorn grade at a speed of 7 miles an hour. Two electric locomotives haul it up the same grade at 14 miles per hour, double the speed formerly obtained by the steam locomotives.

With electric propulsion the same coal traffic can, therefore, be hauled with about one-third the former number of locomotives and half the number of engine and train crews. Of equal interest is the statement recently made by the Commission of Agriculture of the State of Montana in regard to the use of electric power by the Chicago, Milwaukee, and St. Paul Railway, now obtaining 160,000 KW. of electric power from the hydraulic plant of the Montana Power Co., and the saving in fuel effected by this use of water power instead of coal has been very gratifying to the State officials.

The Commissioner states :—"To give an idea of the value of the power which is being generated by these plants, it may be stated that to produce 160,000 KW. from coal would require the yearly consumption of 2,500,000 tons, which, at the average price of $4 which would apply at the points where the power is used, would amount to $10,000,000. When it is considered that the value of this coal is, by means of water power, being saved each year, and that during the next ten years this saving will, in all probability, be increased seven or eight times, it is not difficult to understand that true conservation consists in encouraging the rapid development of water power."

It has been estimated that the shortage of coal last year amounted to 50,000,000 tons; the saving therefore by this one company alone of 2,500,000 tons of Montana coal amounts to 5 per cent. of the total shortage in the country last year.—*Railway Review.*

LEAVES FROM AN ENGINEER'S LOG.

II.—The Trials of Sandy McNab.

By "WHISTLEFIELD."

Running the munition shop with boys was only a qualified success—they needed far too much supervision ; and as the generation of electricity was our main business, and the making of shell a mere side line, the boys were a bit of a nuisance. There were too many hiding places about the station also to which they could retire for a smoke or a sleep, and it was no good threatening to sack them, for boys with any lathe experience at all were in great demand, and commanded good wages all over the town.

The Chief was rather keen to try women on the lathes, but Sandy had all the old-time practical engineer's contempt for innovations of any kind, and especially women among his machine tools ; but in the end it was Sandy who asked for the girls. The boys nearly drove him to distraction, they were careless and lazy, and he could do nothing with them. When he cursed them, they cursed him back, and told him if he wasn't satisfied he knew what to do. Sandy did it, but got tired of continually teaching new boys; besides, the number of his scrap shell mounted up, so he began to listen less sceptically to the Second's reports of how well the women were doing in the various factories in the town, and when a quiet little lad to whom he had refused either an increase or a discharge note scrapped five shells in succession, Sandy capitulated, and told the Chief he could take on the women as soon as he liked, and that he would teach them.

The Chief and the Second talked the matter over, and decided that they must get a superior type of girl, so that there would be no larking between them and the lads. The first two candidates were daughters of one of the councillors. They were got up in great style, and didn't look as if they had ever done a day's work in their lives. The Chief tried hard to discourage them from doing munition work, at any rate under his roof, but they were very keen to try, and I was detailed off to show them the shop. We arrived just as Sandy, standing in the middle of the shop with his back to the door, was giving vent to his feelings on the subject of a boy who had broken some teeth on one of the lathes. I hadn't realised before how lurid Sandy really could be when he was roused. The two fair candidates wanted to know who that "horrid man" was, and when they found out that he was in charge of the munition makers, they did not wait to see any more.

Four girls were finally taken on for a first trial ; three of them were selected as likely to shape well, but the fourth was the chairman's niece, and she selected us as the ones she would honour with her presence. She was extremely pretty, and knew it, and expected to be waited on hand and foot.

When she dropped a spanner or a tool, or got stuck with her work, which was pretty frequent, she would look round so appealingly that at least three lads would leave their lathes, and make a dive to help her ; and she was so touchingly grateful, that they would watch her more closely than their own jobs, so as to be first to the rescue when she got into difficulties again.

Sandy raved inwardly, it was the only way in which he could express himself during the day shift. It was ludicrous to hear him burst out with "What the——" and then suddenly switch off into a very polite inquiry as to how the culprit could possibly have done such a thing. If the culprit was at the other end of the shop from the girls, he got the full benefit of Sandy's thoughts, but in a hoarse whisper. On one occasion when the provocation was unbearable, Sandy is said to have used Gaelic. Rodgers, who was working at the next lathe, and who had been invalided home from Mesopotamia, said, after hearing Sandy on that occasion, that he could quite believe his contention that Gaelic was the language of Eden, it sounded so satisfyingly expressive.

Day after day Sandy petitioned the Second to get rid of "Venus," and finally carried his request direct to the Chief. It took Sandy nearly half an hour to unburden his soul on the subject. The Chief had already heard all about it from the Second, and told him to get rid of her at once. When the Second asked him if there was any special reason he would like him to give the girl for her dismissal, the Chief answered irritably: "Tell her she is no damn good, and I'll explain to my Chairman to-morrow."

What the Second told her I don't know ; they were talking together for a long time, then he sent me to tell the Chief that Venus had decided to leave of her own accord, and was coming up to thank him for all he had done for her.

I gathered afterwards from Venus herself, that the Second had expressed great concern at her working for so long with such heavy shell, in fact, he had made her quite sorry for herself, and finally persuaded her to stop that work at once, take a good holiday, and he would give her an introduction to the managers of two factories where the machines and work were much lighter and safer. I wonder what she would have thought if she had known that he had gone down to dismiss her, if more diplomatic methods had failed.

Venus was quite enthusiastically grateful to the Chief for giving her a chance to do her bit in the War, and the Chief was just going to expand on how pleased he had been to have her on the work when he saw the smile on the Second's face and cut it short.

When he asked the Second afterwards what he had said to her, he replied : "Exactly what you told me to say, but I did it in other words, so there will be no need for you to explain anything to your Chairman to-morrow."

The Electrical Industry in the U.S.A.—In the *Electrical World* of January 5th, a *résumé* is given of electrical progress in 1917, from which we learn that little technical advance has been made, under war-time conditions, but large outputs have been recorded. The total output of energy was about 27,000,000,000 KW.-hours, of which more than half was generated by water power : the remainder consumed only 4 per cent. of the total coal consumption of the country. In most cases the price of energy remains at peace-time rates. Manufacturers have been working at great pressure, largely on Government orders. The year has been the most prosperous in the history of the electrical supplies business, and profits have been good. Excellent progress has been made in research in connection with war problems. The drift in steam turbine practice has been towards large units, high steam pressure, and high temperature. An efficiency of 92·3 per cent. has been attained by a 5,250-H.P. horizontal water turbine installed at a paper mill, which is claimed as the highest recorded for the horizontal type ; a vertical turbine some years ago reached 93·7 per cent., which is also regarded as the record for the type.

Continued attention is being given to the temperature rise in electrical generators. An 8,000-K.V.A., 44,000/6,600-volt, 60-cycle, self-cooled transformer has been set to work, and is believed to be the largest self-cooled unit in existence. An auto-transformer of 25,000 K.V.A., transforming 12,000 to 24,000 volts, and therefore controlling an output of 50,000 K.V.A., is being built.

Great progress has been made in the manufacture of high-pressure insulators. A new type of lightning arrester, with the characteristics of the aluminium arrester but entirely dry and requiring no charging, has been developed.

The demand for electric motors and controllers has been urgent. Important developments have taken place in storage battery practice, especially for Government use, but cannot be disclosed at present.

Mr. T. C. Martin, secretary of the National Electric Light Association, in the same issue deals with statistics. He estimates the revenue of central stations in 1917 at £110,000,000, an increase of 10 per cent. over 1916. The traction revenue is put at £160,000,000, an advance of one million. The total operating revenues of the Bell telephone system are estimated at over £58,000,000, and of the whole of the telephone systems at £85,000,000. Telegraph companies' earnings are expected to aggregate £35,000,000. Manufacturing revenue is uncertain, but Mr. Martin estimates it at £120,000,000 ; the General Electric Co. has stated that its orders for 1917 amounted to £48,000,000. Miscellaneous electrical industries are figured at £25,000,000. The grand total is £565,000,000, or an increase of about 10 per cent.

Molybdenite in Ontario.—An Eastern molybdenite company (says the Agent-General for Ontario) has secured an option on 200 acres near Kakabeka Falls. The vein has been proved to a depth of 50 ft., and a cross-cut shows it to be at least 16 ft. wide. The ore will grade over 1 per cent., or about 20 lb. to the ton.—*Financier*.

INSULATION UNDER DIRECT AND ALTERNATING CURRENT, PARTICULARLY AS REGARDS MOISTURE.*

By PROF. THORNTON.

(*Address delivered before the North of England Branch of the* Association of Mining Electrical Engineers.)

1. *The Electrical Structure of Matter.* Matter is made up of minute electrical charges called electrons; the negative electrons are light, the positive electrons relatively heavy. Atoms are probably groups of negative electrons in motion, or grouped around a positive nucleus, or some aggregate of such systems. The difference between conductors and insulators is that in the former a stream of negative electrons can take place from atom to atom, forming an electric current in the conductor, while in dielectrics or insulators electrons cannot be separated from the atomic structure except under great electrical forces. What happens in the insulation of a cable is that the insulating material becomes polarised; that is, there is a separation or displacement of charge in the atoms of the material, so that if the wire is positive, the side next to it acquires a negative charge, the side next to the sheath an equal positive charge.

2. *Residual Charge.*—This separation of charge is aided by the mutual attraction between neighbouring charges (fig. 1), which causes a slow polarisation added to that first started by the applied voltage, which may grow for 48 hours. It is this that gives rise to residual charge in condensers. The voltage on the conductor of a cable left insulated after being charged for a long time by unidirectional voltage may be much greater than the original charging voltage. For $V = Q/K$, and a small quantity Q soaking out of the standing insulation after the voltage has been cut off can, if the capacity K of the cable is small, cause the voltage V to reach very high values.

There is no residual charge with alternating current, for there is little time to establish the mutual attraction between molecules before the field is reversed. This is the first significant difference between continuous and alternating-current distribution, though it plays no very important part in practice, except, perhaps, in breakdown voltage.

3. *Breakdown Voltage and Frequency.*—The voltage per unit thickness at which an insulating material can be broken down depends greatly on the time of application of the voltage, or on its frequency in the case of alternating voltages. The relation has the shape shown in fig. 2, the formula for which is :—

$$V = V_\infty (1 - \epsilon^{-an}) + V_0 \epsilon^{-an}.$$

So that when n is large, ϵ^{-an} is small, and V approaches the value V_∞. When n is zero, that is for steady voltage, V is large. This is due to viscosity preventing charge taking up the proper electric stretch.

4. *Nature of Breakdown.*—The nature of the process by which a dielectric, such as india-rubber or glass, breaks down, is still obscure. When the voltage is applied, the charges, which are always in the molecules, are separated; that is, the negative charge in one molecule approaches the positive charge in the next in line. When the force due to their own attraction, aided by the external field, bringing these together, exceeds that which the mechanical structure of the atom can support, the negative charge at some one point rushes across to the next atom, and there is a slip of negative charge along a line of molecules; that is, along the path of breakdown. The molecules exchange negative electron partners all along the line. This produces a kind of internal explosion. It is not a spark driven from outside through the insulation, but a slip of charge within it. If the damage to the molecular structure by this slip is sufficiently great, the original "puncture" may be followed by a rush of current from the circuit much greater than that at breakdown, but it is possible for the insulation resistance of a system to be better after a spark through it than before. This has been known to happen.

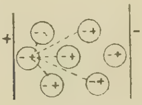

Fig. 1.

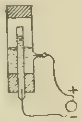

Fig. 3.

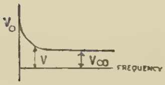

Fig 2.

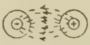

Fig. 4.

5. *The Breakdown of a Cable* is, under certain circumstances, facilitated by porosity giving rise to osmosis. Evershed has pointed out the enormous importance of osmosis, especially of what is called electrical endosmose, in the phenomena of insulation. There may be a surface creep of water by a process which is extremely interesting to watch under the microscope. Small drops of moisture form on any surface below the dew-point, and when these are electrified they run together by a kind of spray effect from the side next to the live conductor, so that a film eventually forms. Wax on the surface stops this. A good illustration of how it occurs is given by the following simple apparatus:—A glass tube with rubber stoppers (fig. 3), partly filled with water, contains an inner tube having at the bottom a platinum wire fused in. A wire through the side is connected to a Wimshurst machine, and it is found that water collects in the negative part of the tube. That is, it is carried over from positive to negative. Reversing the polarity, the water returns and piles up in the opposite direction. Water always goes in the same direction as a current would flow. The reason for this is not very clear, but it would appear to be that the edges of the water film form, as it were, a fine point or wedge, and the electrical forces at a point, such as a lightning rod or a needle, are, as is well known, much larger than those at a rounded surface. The film is, therefore, torn up and sprayed onward, so that the water advances along the surface like a molecular watering cart, with the spray in front.

This effect is even more marked in fine capillary tubes or thin layers than on a free surface, and plays an important part in vegetable growth.

6. *Under Direct Current,* moisture between cables is urged along the lines of force from the positive to the negative conductor (fig. 4), and if there is a fault—or two faults, or a generally faulty cable—moisture penetrates the negative insulation and gathers next to the conductor, forming sometimes a kind of sac full of liquid. In one case it was found necessary to cut the cable and put in a drainage tank holding a gallon or two, which filled in a few weeks by moisture driven through the insulation in this manner.

Experiments were conducted by Mr. Vernier, of the Newcastle Supply Co., which illustrated this clearly. Cables were buried in damp ground and connected to the supply network at 240 volts. When the voltage was direct, the leakage of current rose slowly in 45 hours to one ampere; moisture collected at the negative cable in large quantities with evolution of steam. When the voltage was alternating, the current at switching on was 1·5 amperes, but fell in a few hours to zero. That is, an alternating-current fault dries itself out completely under the most unfavourable conditions, while a direct-current fault gradually but surely gets worse until the insulation in its neighbourhood is completely destroyed by the passage of the moisture and the heat of the leakage current.

Prof. Thornton gave the appended figures, which showed that a very faulty direct-current system, on being converted to alternating current, cured itself automatically, and last year had only one fault. Facts like these, he said, were conclusive that A.C. supply in moist ground, or wherever moisture had access to the insulation, was very much safer than direct current. The figures were :—

	Year.	No. of faults.
Direct current	1909	210
	1910	162
	1911	171
Transition	1912	114
	1913	59
Alternating current ...	1914	15
	1915	14
	1916	1

The "Safety First" Movement.—A record of the activities of the London "Safety First" Council—a body formed in December, 1916, to promote increased safety in the use of the streets and railways within Greater London—was submitted at the first annual meeting of the organisation. Among the members of the Council are representatives of 45 local authorities (six of whom control tramway undertakings), several railway, tramway, and omnibus companies, vehicle workers' associations, technical societies, professional organisations, and commercial firms. During the nine months ended September, 1917, the number of street accidents within the Metropolitan Police District showed a reduction of 10 per cent. on the total for the corresponding portion of the preceding year, and the number of persons killed in the streets fell from 577 to 489. An attempt has been made to systematise the methods of street illumination and the lighting of vehicles, with a view to the convenience of traffic in the darkened streets. Competitions and awards have aided in arousing interest in the Council's objects. —*The Times.*

Battery v. Magneto Ignition in America.—A census was taken at the recent motor-car exhibitions in New York and Chicago, which revealed the fact that, taking the different makes of cars displayed, the number fitted with battery ignition had increased from 56·4 per cent. in 1916, and 72·2 per cent. in 1917, to 77·5 per cent. for the current year, there being a corresponding decline in cars fitted with magneto ignition from 43·6 per cent. and 27·8 per cent. to 22·5 per cent. The tendency is, of course, mainly due to the fact that practically all American cars are now fitted with dynamos and batteries for lighting purposes, the batteries being also used to furnish current for ignition.

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* From the *Iron and Coal Trades Review.*

PROCESSES FOR THE MANUFACTURE OF ALUMINIUM.

(*Concluded from page 222.*)

Operation.—In order to start the furnace, the upper electrodes are brought down on to the lower electrodes with the intervention of a small resistance, generally provided by small pieces of carbon. Cryolite alone, or mixed with fluxes, is added gradually to the furnace, and when these materials are molten the current is increased to its normal value, more material being added meanwhile. The anodes are raised slowly, and when the volume of the bath is sufficient, alumina is added and stirred frequently to favour its solution. In order to protect the bath continuously against the cooling and oxidising influence of air, it is covered with a layer of powdered alumina. As the deposition of aluminium proceeds, more oxide must be added from time to time, and an ingenious means of indicating when more oxide should be added consists of an incandescent lamp (or several in series) shunted across the terminals of the furnace, the resistance of the filaments being chosen so that the lamps light up when the percentage of alumina in the bath is insufficient. Cryolite and fluxes have generally to be added at intervals of several days.

It is essential that the density of the bath be lower than that of molten aluminium, in order that the latter may sink to the bottom, where it must be protected continuously against oxidation by a sufficient depth of molten salts. Solid cryolite has a density of 2.92, but this falls to 2.08, giving a margin of 0.46 compared with the density of molten aluminium, which is 2.54. The addition of alumina and fluxes does not increase the density of the bath, and inversion of densities due to incorrect composition of the bath occurs very rarely.

If an aluminium furnace becomes too hot, the flame round the anodes extends and becomes yellow. The remedy is to lower the anodes. Metal collects continuously at the bottom of the furnace, and is tapped at intervals of two or three days, according to the dimensions of the furnace. Tapping is effected not directly, but into a ladle which retains fluorides in the solid state.

Furnaces are best installed in a single line or in parallel rows in a large building. There are other arrangements less expensive in first cost, but also less convenient in working, and favouring the accumulation of heat.

Efficiency, &c.—The efficiency of an individual furnace during normal operation varies from 90 to 95 per cent. of the theoretical value, but the overall annual efficiency varies with the number of furnaces used simultaneously, with the power of each furnace, and with operating mishaps. According to M. Flusin, the average production ranges from 460 to 605 lb. of aluminium per KW.-year, corresponding to an energy expenditure of 1.86 to 1.41 KW.-hour per lb. of metal, and an industrial efficiency of from 58 to 76 per cent.

As regards consumption of materials, this amounts to 2 lb. of alumina, and from 0.7 to 1 lb. of anodes (including stumps) per lb. of aluminium produced. The consumption of cryolite and fluxes is very small (say 0.12 to 0.2 lb. of cryolite and 0.2 lb. of calcium and aluminium fluorides); the wastage of these materials is due to secondary electrolysis volatilisation and loss in crushing, and may be reduced by skilful manipulation.

Alternative Processes.—If one attempts the electrothermic reduction of alumina alone, there is the risk that part of the aluminium may be volatilised and reconverted to alumina, whilst the remainder may be converted to carbide. The Cowles process is based on the reduction of alumina by carbon in the presence of iron and copper, at the temperature of the electric furnace. The products obtained are pure aluminium, and an alloy, viz., ferro- or cupro-aluminium.

The Tucker and Moody process uses a mixture of alumina, 150 parts; calcium carbide, 200 parts; and coke, 60 parts. Calcium carbide is first formed by reaction between line and carbon at the temperature of the electric arc. The exothermic nature of this action develops enough heat to facilitate the reduction of alumina, but unless the process is completed quickly there is considerable risk of forming aluminium carbide.

The preparation of aluminium from its silicates, *i.e.*, clays, offers great possibilities of cheapening the metal. In the Cowles-Kayser process, ordinary clay is mixed with carbon and sea-salt; the mixture is heated to 1,000 deg. C. and yields, besides valuable by-products, a complex silicate of aluminium from which alumina is prepared by the action of quicklime.

It is claimed that by the Moldentrauer process the price of aluminium is reduced to 2.15d. per lb. A mixture of crushed clay, hematite and coke is subjected to the action of a heavy current. By using a suitable proportion of iron oxide, and adding part of the iron in the form of ferro-silicon, the furnace may be made to yield a mixture consisting almost exclusively of ferro-silicon and alumina. The latter is crushed and passed through a magnetic separator to remove globules of ferro-silicon. The yield of aluminium is about 70 per cent. of the theoretical value. Ferro-silicon with high silicon content is obtained from the first electric furnace, together with impure alumina which is melted and electrolysed in a second furnace.

Production and Consumption of Aluminium.—Until 1896 Switzerland produced more aluminium than any other country. Now, however, the annual production is, roughly, as follows:—

United States and Canada	18,000 tons.
France	15,000 tons.
Germany and Austria-Hungary	10,000 tons.
Switzerland	6,000 tons
United Kingdom	3,000 tons.
Norway	1,500 tons.
Italy	1,000 tons.

France exports the most aluminium, and is at the head of the European market. French deposits of bauxite yield 130,000 tons per annum (out of a world's total of 170,000 tons), and since the expiration of the Heroult patents in 1907, the number of aluminium works in France has increased rapidly. The Soc. Electrometallurgique Francaise produces 9,000 tons of aluminium per annum from its works at Largentiere, La Praz, and La Saussaz; the Cie. des Produits Chimiques d'Alais, &c., produces 7,000 tons from works at Calipso, St. Jean, and St. Felix de Maurienne, and Pontamafrey; the Soc. d'Electrochimie produces 1,000 tons at Premont; and the Soc. des Produits Electrochimiques des Pyrenees produces 3,000 tons at Auzat. The principal works are thus in Savoy, in the valley of the Maurienne; between Modane and St. Jean there are six works representing 80,000 H.P.

The principal aluminium companies outside France and their annual outputs are:—Aluminium Industrie Gesell.: Neuhausen 1,000 tons, Chippis 4,000 tons, Rheinfelden 600 tons, Lend-Gastein 1,200 tons. British Aluminium Co.: Foyers 800 tons, Stangfjord 1,000 tons. Aluminium Corporation: Dolgarrog 1,800 tons. Anglo-Norwegian Aluminium Co.: Vigeland 500 tons. Soc. Italiana dell'Alluminio: Bussi Pescara 1,200 tons. Soc. Italienne d'Aluminium: Popoli 1,000 tons. Aluminium Co. of America: (Niagara, Massena, Quebec, and Shawinigan) 18,000 tons.

In the whole world there is about 350,000 H.P. devoted to the production of 60,000 tons of aluminium. For a year or two after the expiration of the Heroult patents (1907) there was over-production, but the demand then overtook the supply, and since 1910 there has been a fair state of equilibrium between production and demand. Since the beginning of the war the use of aluminium and its alloys for munitions purposes has extended enormously, and there can be no doubt that aluminium (and its alloys), which is already in the sixth place in the scale of metals commonly employed, will rise much higher still. In the form of clay, aluminium is the commonest of all metals, and in view of the great extent to which it is now employed for all manner of purposes it is interesting to recall that it was almost a precious metal in 1855, when it cost £23 per lb. In 1866 the price fell from £2 5s. to 28s. a lb.; by 1890 it had reached 7s. per lb.; and for 10 years past the price has been about 8d. a lb.

Electric Truck Service in Chicago.—The Commonwealth Edison Co., of Chicago, has recently brought into service an electric garage, in connection with which a complete garage and maintenance scheme for commercial electric vehicles has been introduced. The primary idea is to offer a service in which all transportation costs are guaranteed. Only new electric trucks of standard type and equipment are to be given the benefit of the new service, which covers storage and cleaning, battery charging, maintenance and upkeep of gearing parts, including batteries, tires, &c. This maintenance covers ordinary upkeep of minor repairs as well as renewal of tires and batteries, when necessary: it also includes painting the body, it being intended to leave the vehicle practically like new, ordinary wear and tear excepted, at the end of the four years' contract period. The cost of rendering the service has been based on the company's own experiences, extending over 15 years, with a fleet that has grown to 182 cars.

The service is charged for on a monthly flat rate, depending, of course, on the type of vehicle and its equipment, and including a normal battery charge each day: additional charging, boosting, or the use of an extra battery would necessitate an increased rate. The rate depends on the average service rendered, and, being a fixed flat rate, enables the owner to know what his transportation will cost each year, when taken in conjunction with drivers' wages, interest, insurance and taxes.

The garage, known as Service Station No. 1, holds about 100 vehicles: other stations are to be built as occasion may demand. Direct current energy at 115-230 volts is led in from two sources, the cables terminating in 1,500-ampere triple-pole switches on the control board; 58 charging circuits are provided, these running overhead to points on the ceiling directly over each charging outlet.

A special junction or terminal-box is provided over each outlet: in this connection is made to a flexible cable hanging loosely from the box, the cable being securely anchored in the box: at 5 ft. above floor level, a double-pole connecting receptacle is fitted from which a short flexible jumper is connected to the vehicle under charge. With this arrangement careless starting of the vehicle only results in opening the lower connecting receptacle. A special washing rig is provided, in which the action of pulling down the hose starts the flow of water, while the next pull stops it: this saves wear and tear of hose on the floor, and saves water, which is an important matter in winter, when warm water is supplied.—*Electrical Review* (U.S.A.), Vol. 71, No. 26.

THE RÖNTGEN SOCIETY.

At the meeting of the Rontgen Society on March 5th, Mr. Howard C. Head gave a demonstration, accompanied by kinematograph views, of a mobile X-ray wagon unit which has been constructed by Messrs. Siemens Bros., Ltd., for service on the Mesopotamia front (a similar equipment has been in use for some time in France). He said that the designing of a travelling X-ray ambulance opened up great possibilities alike for the automobile and the electrical engineer, and the value of such an equipment was obvious, for by this means it became possible to have the X-ray apparatus and its power unit taken to its work, instead of the work having to be brought to some centre where current was available. A particular form of chassis was chosen for its low loading line, which made it practically equal to the underslung type of car; the panel teak body mounted on the chassis was about 13 ft. long by 7 ft. wide, and was divided into two compartments, one of them a photographic dark-room, and the other the room containing the X-ray apparatus. In addition, the caravan carried a portable X-ray theatre, formed by means of a framework of poles and tie-rods erected at the side of the car, over which a tent canvas roof and sides could be adjusted. Turning to the electrical equipment of the vehicle, Mr. Head said that the generator was situated on the exhaust side of the engine, and was driven by means of a Westinghouse-Morse rocker chain from the main shaft of the engine. It was designed to give an output of 3 kw., or 20 amperes at 150 volts when the engine was running at 1,700 r.p.m. The rocker chain was disconnected when the car was running on the road, and was only connected when the generator was to be used either for running the X-ray plant direct or for charging the battery of accumulators. This battery was fitted in two special cupboards at the back of the driver's cab, and the doors of these cupboards were fitted with louvres to ensure perfect ventilation; by this arrangement no acid fumes could enter the car. The battery was built up in special ebonite composition boxes, which were superior to celluloid, because the latter material decomposed under the influence of heat. The battery consisted of 38 2-compartment, 4-volt units, making 76 cells in all of the sealed-in type, and the capacity of each cell was 80 ampere hours (intermittent), or 10 amperes for 2½ hours, or 30 amperes for 5 minutes. Therefore the X-ray operator was provided with a supply of energy capable of undertaking the quickest work and the most difficult cases, for he could run the generator and accumulators in parallel. The X-ray equipment provided was the standard War Office equipment for field service, together with various additions, including a Coolidge control outfit, a number of tungsten target tubes, an intense discharge induction coil, and three interruptors of different types. The connections were so arranged that X-ray work could be done either in the car itself or in the canvas annexe, or, by means of cables from the power apparatus, in the room of a hospital or house. Mr. Head said that the unit would have a utility even after the war was over, as, for instance, in mining districts and in scattered areas where no established X-ray plant was available within a convenient distance.

At the same meeting Dr. C. R. C. Lyster and Dr. Sidney Russ read a paper on "A Biological Basis for Protection against X-rays," in which they described a photographic method (in preference to an electroscopic one) of discovering the amount of X-rays to which the operator was subjected in the course of his daily duty. In the subsequent discussion the opinion was expressed by more than one medical man that susceptibility to X-ray dermatitis differed greatly according to the individual, and that in view of this element of personal idiosyncrasy it was almost impossible to lay down hard and fast rules as to the damaging dose.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

3,268. "Electric starters and controllers." E. Schattner & J. R. Walton. February 25th.

3,272. "Magneto drives of motor cycles, &c." James Cycle Co. & W. F. Lechmere. February 25th.

3,277. "Electric cables." W. J. Howard. February 25th.

3,283. "Electric controllers of the barrel type." W. G. Pipkin and Veritys, Ltd. February 25th.

3,303. "Variable resistances of rheostats." Siemens & Halske Akt. Ges. February 25th. (Germany, February 15th, 1917.)

3,304. "Automatic telephone systems." Automatic Telephone Manufacturing Co. February 25th. (U.S.A., March 19th, 1917.)

3,305. "Automatic telephone systems." Automatic Telephone Manufacturing Co. February 25th. (U.S.A., May 23rd, 1917.)

3,308. "Cells or boxes for power and lighting electric accumulator for train lighting, central stations, and submarines." A. V. Downton. February 25th.

3,330. "Automatic snow-shaking apparatus for electric lines." V. Cisari. February 25th. (Italy, April 30th, 1917.)

3,333. "Machine switching telephone exchange systems." L. Polinkowsky & Western Electric Co. February 25th.

3,335. "Electric conductors." A. Brandes, Elektro-Elevator Brandes and Winkler & A. Winkler. February 25th.

3,351. "Electric signalling apparatus." H. E. Crammond & C. E. Falconbridge. February 26th.

3,379. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. Hunt & Sandycroft, Ltd. February 26th.

3,381. "Means for preventing electric conductors of traction systems being coated with ice." P. C. Edwards. February 26th.

3,396. "Insulated conductors." J. A. L. Dearlove. February 26th.

3,397/8/9. "Generating power." Westinghouse Machine Co. February 26th. (U.S.A., August 11th, 1916.)

3,408. "Electric light fittings and brackets." L. Harrison & E. R. Hough. February 26th

3,414. "Electric accumulators." Chloride Electrical Storage Co. & H. Dean. February 26th.

3,418. "High-voltage distributors for electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 26th. (Germany, March 14th, 1917.)

3,420. "Process for making metals in electric furnaces." E. Humbert. February 26th.

3,430. "Accumulators, &c." V. G. Yourieff. February 26th.

3,431. "Manufacture of iron by electrolyses." C. Arzano. February 26th. (Italy, March 19th, 1917.)

3,436. "Electric oil heater." R. B. H. Gossage. February 27th.

3,440. "Electromedical apparatus." E. E. Greville. February 27th.

3,446. "Electric height-indicator." R. B. T. Pinkney. February 27th.

3,452. "Manufacture of electric cells." O. Silberrad. February 27th.

3,457. "Electric reversing switch mechanism." R. K. Wallace. February 27th.

3,460. "Supply of electrical energy to furnaces, &c." W. Travis and T. H. Watson & Co. February 27th.

3,478. "Attachment of telegraph wires to insulators." W. A. Davis. February 27th.

3,480. "Combination of telegraph and telephone apparatus." L. E. Austing. February 27th.

3,496. "Dynamo-electric machines." G. Plaisant. February 27th.

3,497. "Dynamo-electric machines." G. Plaisant. February 27th.

3,505. "Production of spongy lead." V. G. Yourieff. February 27th.

3,526. "Sparking plugs for explosion motors." Soc. Anon. Carburateur Aris. February 27th. (France, March 16th, 1917.)

3,530. "Machine switching telephone exchange systems." L. Polinkowsky and Western Electric Co. February 27th.

3,532. "Carbon conductors." G. N. Antonoff. February 27th.

3,541. "Method of electrification of the soil for farming." R. F. Hall. February 28th.

3,542. "Method of electrification of seed and grain." R. F. Hall. February 28th.

3,548. "Electric cables." W. J. Howard. February 28th.

3,575. "Dynamo-electric machines." J. W. Burleigh. February 28th.

3,577. "Method of generating pressure." Westinghouse Electric and Manufacturing Co. February 27th. (U.S.A., March 31st, 1917.)

3,584. "X-ray tube stands." C. E. S. Phillips. February 28th.

3,601. "Electric motors." E. S. Franklin and Stothert & Pitt. February 28th.

3,617. "Starting switches for electric motors." Officine Elettro-Meccaniche & W. P. Thompson. March 1st.

3,623. "Jointing electric cables." W. J. Howard. March 1st.

3,643. "Gas and electric fittings, candlesticks, &c." J. Harrington. March 1st.

3,650. "Sparking plugs." G. Parsons & T. C. E. Rowland. March 1st.

3,656. "Lamp mountings for electric light projectors." Stewart-Warner Speedometer Corporation. March 1st. (U.S.A., June 19th, 1917.)

3,660. "Electric batteries." G. N. Antonoff. March 1st.

3,670. "Electric switches and contacts." F. A. Ross. March 2nd.

3,676. "Transmission of electrical energy." P. W. Gray. March 2nd.

3,690. "Dynamo-electric machinery." J. W. Burleigh. March 2nd.

3,708. "Electromagnetic clutches." T. S. Duncan & Vickers, Ltd. March 2nd.

3,709. "Slip-ring short-circuiting and brush-contact releasing gear." A. H. Bennett & Phoenix Dynamo Manufacturing Co. March 2nd.

3,718. "Couplings or connecting devices for electric circuits." V. H. Broc. March 2nd. (France, March 14th, 1917.)

3,721. "Means for starting internal-combustion engines." J. Etchells, C. H. Stedman & Vickers, Ltd. March 2nd.

3,722. "Switches for controlling electric motors." J. Etchells, C. H. Stedman & Vickers, Ltd. March 2nd.

3,726. "Electric furnaces." J. Bibby. March 2nd.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,452. Variable-speed Generators and Storage Battery Systems. H. A. Gill (U.S. Light & Heat Corporation). December 5th, 1916. (113,108.)

18,389. Safety Apparatus for Preventing Increases of Potential in Electric Installations. E. C. R. Marks (E. Uytborck). December 26th, 1916. (113,110.)

1917.

362. Electric Heating Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 18th, 1917. (113,118.)

1,796. Electric Fuses. Simplex Conduits, Ltd., L. M. Waterhouse and J. F. Avila. February 5th, 1917. (113,130.)

1,867. Electromagnetic Switches. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) February 6th, 1917. (113,132.)

1,930. Art of Metering Electricity. E. O. Schweitzer. February 8th, 1917. (113,139.)

1,962. Electric Ovens. J. Bradley. February 8th, 1917. (113,142.)

1,985. Electric Lamp Locks. J. H. Collie. February 9th, 1917. (113,145.)

2,268. Electromagnetic Switches. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 15th, 1917. (113,150.)

2,320. Electric Switch. H. G. Longford, W. W. Longford & W. A. Clark. February 16th, 1917. (113,152.)

3,615. Electric Couplings. H. de la Valette. March 31st, 1916. (105,227.)

4,147. Oil-insulated Electric Apparatus. A. Duckham & Co. and S. E. Bowrey. March 21st, 1917. (113,172.)

4,679. Electrical Switches. J. Roberts. March 31st, 1917. (113,176.)

5,067. Telegraphic Receiving and Tape-perforating Apparatus. A. L. Muirhead, A. C. Huskingson and Muirhead & Co. April 10th, 1917. (113,184.)

6,046. Composite Electric Insulating Substances. J. L. Major & P. J. Pybus. April 28th, 1917. (113,194.)

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THE IMPERIAL WIRELESS CHAIN.

SELDOM, if ever, we should think, has a Government contract of world-wide importance had such a chequered history as that of the famous Imperial wireless chain. Almost from the inception of this great scheme it was made the sport of party politicians; the first agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., which was signed on July 19th, 1912, providing for the erection of six stations to maintain communication between this country and our African and Asiatic possessions, was promptly challenged directly its terms were made public, and a Select Committee was appointed to inquire into the circumstances attending the negotiations. Rumours began to take shape regarding alleged financial transactions in which even Ministers of the Crown were involved, and the erection of the Imperial chain, declared a matter of national urgency by the Committee of Imperial Defence in December, 1910, was delayed for more than two and a half years by the machinations of the political wire-pullers.

Not one of those six stations, incessantly demanded by our military authorities as urgently needed for the defence of the Empire, was ever erected! Grim light is thrown on the subject by the facts revealed in the speech of Sir Edward Carson, in opening the case for the Marconi Co. in its action for damages against the Government last week-end. The war broke out before a single station was ready, and it is not surprising that the Government decided not to go on with the scheme; what is a matter for astonishment is that a great department of the Government attempted to shuffle out of the agreement, and that it continued to shilly-shally and to refuse to admit its liability to compensate the company for its heavy outlay and the loss of prospective revenue of which it was deprived by the decision to abandon the scheme. No wonder the Attorney-General and Solicitor-General were unable to persuade themselves that a position so utterly untenable could be seriously maintained in a court of law, and they acted rightly in "throwing up the sponge" before a single witness had been called.

As for the transactions that are alleged to have taken place between a Postmaster-General and another Member of Parliament and the German competitors of the company, seeing that the allegations have been strenuously denied, we must for the moment withhold comment; if they were proved to be true, or even well-founded, they would assume the very gravest importance, and could not fail to lead to results of the most painful character. It was, perhaps, unfortunate that the gentlemen concerned were not afforded an opportunity of meeting these charges in the witness-box. But we may say one thing—the point to which we are leading: throughout the whole course of events, from the first proposal of the Marconi Co. to erect a chain of long-distance stations to the present date, Mr. Marconi and his company have emerged from the mire through which the politicians have dragged his name, with an unblemished record; not a single item of the charges that have been brought against the company has ever been substantiated, and it has never been shown that the company has acted otherwise than in accordance with the dictates of commercial rectitude. We feel that the nation owes to the company, and in particular to Mr. Marconi, a frank and ample apology for the unfair, un-British, and unscrupulous treatment accorded to them by Parliament and the Post Office.

National Electricity Supply.

Elsewhere in this issue we publish an abstract of an address by Mr. S. L. Pearce, which derives exceptional weight and importance from the fact that the speaker is the engineer and manager of the largest and most successful municipal electricity supply undertaking in the United Kingdom. The subject was the Interim Report on Electric Power Supply, and Mr. Pearce, while he agreed with the report in the main, handled very severely some of its principal features; we take it that his views may be accepted as those of the larger municipal undertakings of the country on this subject, and, as we anticipated in our issue of January 4th, he regards the report to some extent as an attack upon the principle of municipal ownership and control, which has become so firmly established in this country. He advocates the adoption of the principle of public control, at any rate for Lancashire, on similar lines to those which we indicated as likely to be acceptable to the municipalities—namely, by the formation of an authority that has no shareholders and pays no dividend, features of company management which, apparently, are anathema to the municipal mind.

Turning to the technical aspects of the matter, we again find that Mr. Pearce's views run on lines parallel to our own, expressed in our issue of January 11th. He points out that Tyneside, whose influence is so markedly reflected in the report, enjoys exceptional advantages of circumstance—yet possesses no "super-station"; that sites combining the *desiderata* of abundant supplies of coal and water are conspicuously rare in other parts of the country; and that the question of site resolves itself into the choice between lengthy transmission lines on the one hand and the use of cooling towers on the other, with the transport of coal as an additional consideration, all of which points were mentioned in our article.

The comparison given in the report between the relative costs of company and municipal supply is shown to be misleading, for the reason which we pointed out—namely, that the conditions obtaining in the areas concerned are not comparable. We also drew attention to the suggestion contained in the report that the average consumption of coal per H.P.-hour in factory installations was of the order of 5 lb., a figure which must be regarded as unduly inflated; while Mr. Pearce did not commit himself to an alternative estimate, he pointed out that the report was based upon this figure, and let it be plainly seen that he could not accept it as correct. We are pleased to find that our comments are in every respect confirmed by so eminent an authority.

Whitley Committees for Less Organised Trades.

The second Whitley Report has now made its appearance. It deals with industries in which organisation on the part of employers and employed is less completely established than in the industries covered in the first report, and with industries in which such organisation is weak or non-existent. Industries are classified according to the degree of organisation. Group "A" consists of those in which organisation is sufficiently developed to render the respective associations representative of the great majority of those engaged in the industry; these were the subject of recommendations contained in the first report, which has been made the basis of
so much discussion recently. Group "C" co
prises industries in which organisation is so imp
fect that no associations can be said to be adequat
representative. Between these two there is Gro
"B," which includes industries in which the deg
or organisation, though considerable, is l
marked than in Group "A." It is considered t
in the main the proposals of the first report sho
be applied to the "B" group, *i.e.*, those found
be relatively well organised, but it is suggested t
where in these industries a National Industrial Cou
cil is to be formed there should be appointed one
two official representatives to assist in the initiati
of the Council, who should continue, after its est
lishment, to act in an advisory capacity and se
as a link with the Government. Such representat
should be there merely in an advisory, and n
in a voting, capacity, and experience should deci
whether he should be retained, such retention bei
always subject to the wish of the Council itself.
may be that in some areas the establishment of D
trict Councils for "B" industries can be effect
to act in conjunction with the National Counci
In others, the National idea may not be immediat
practical; but even here the District Councils mig
be formed, and it is anticipated that their formati
would so influence the course of affairs that the
dustry would become suitable for National Counc
to be formed also. Both Councils should, as in t
case of "A" industries, be composed of represe
tatives of the Employers' Associations and Tra
Unions concerned, and the claims of women shou
be recognised. No fixed standard is laid down
organisation which should exist before Councils a
formed. There is so great diversity of circu
stances and such different degrees of section
organisation, that the Committee favours leavi
the matter to the decision of the Ministry of Labo
and the organisations concerned. In regard
Group "C" it is thought that the machinery of t
Trade Boards Act might be applied, pending t
development of a larger degree of organisation, b
such Boards should be empowered to perform larg
functions than at present, enabling them to de
not only with minimum rates of wages, but wi
hours of labour and cognate questions, also to co
duct inquiries on matters affecting the industrie
It is to be left to the Minister of Labour to ta
appropriate measures for appointing such Boar
where they are desired. Careful examination nee
to be given to the question whether Works Co
mittees can be applied in the case of Group "C,
and the Ministry of Reconstruction has issued
separate report dealing with this point. Limitatio
of space prevent our entering into these matters
such detail as we should have desired under oth
circumstances, but we trust that our readers wh
by reason of their connection with industrial co
cerns, are specially interested in proposals whic
are advanced to simplify and harmonise industri
relationships, will secure both the Second Whitl
and the Works Committee reports. In short, it
thought that most of the principal industries of t
country can be brought under one or other of t
schemes now set forth. Broadly, they would
industries with Industrial Councils, and industri
with Trade Boards, while further, in the case of t
former class, it is possible that in certain sectio
or areas they might find it practicable to have Tra
Boards associated with the Industrial Councils f
determining wages and hours. It is recommend
that State Departments and municipal authoriti
employing labour should now be interested in thes
matters as well as private industries. It will b
observed that the whole policy is based upo
organisation. It must also again be stated that t
proposals are not advanced with any idea that the
can be uniformity in practice in applying them
They must necessarily be adapted to meet the var
ings needs and circumstances of different industries

ELECTRICAL DEVELOPMENTS IN ITALY.

By E. STRACHAN MORGAN.

(*Concluded from page* 244.)

(2) When the application of water-power to electricity began to develop it was discovered that, save in exceptional circumstances, or when a business under favourable conditions produced electricity for providing power for its own purposes, it was only installations on a large scale, and with ample capital, that could work economically. The tendency has, therefore, been towards amalgamation and absorption, the number of companies being reduced and the field of their operations greatly enlarged. Take, for example, the Societa Ligure Toscana di Elettricita. This company was formed in 1905, with a capital of L1,000,000, for the service of the city of Leghorn. In 1907 its capital was L2,000,000, it provided 24,000 lamps and 3,500 H.P. In 1915, its capital had risen to L22,000,000; it provided 270,000 lamps and it produced 20,000 H.P., and had a plant in construction for another 10,000 H.P., and served the entire Provinces of Lucca and Livorno, and parts of the Provinces of Pisa, Massa, Firenze, Grosseto. Meanwhile it had absorbed the following companies:—Societa di Pisa, Societa Livornese, Societa di Lucca, Societa di Monte Catini, Societa di Monsumano, and several others. So again the chairman of the Societa Adriatica di Elettricita, in 1917, stated that, besides their share capital of L27,000,000 and debenture L5,000,000, the company had an overdraft of L11,500,000, and utilised it all; that the capital would be increased to L36,000,000; and that the Societa Italiana del Veneto, in which the Adriatica is largely interested, has increased its share capital from L14,000,000 to L15,750,000. The Verona Companies, in which the company is also interested; *i.e.*, the Societa Elettrica Milani, the Societa Veronese di Elettricita, the Societa Interprovinciale, have become more closely combined. The Adriatica has also contributed L100,000 towards founding the Societa Nazionale per Imprese Elettriche. It has large holdings in the Imprese Elettriche in Italia, and in the Societa Toscana per Imprese Elettriche. These are typical examples of what has occurred elsewhere.

The advantage of concentrating under a single management the supply of power to numerous manufacturers, and of controlling many sources of water-power, is very great. Besides the saving in office expenses and other general charges, there is the enormous advantage of the ability to equalise and average out the distribution of energy to many clients, some of whom may be slack in their work while others are in full blast; and it is of at least equal importance to be able to utilise the spare power of one set of turbines to supplement that of some other station where the water-power may be temporarily deficient. This centralisation, either by amalgamation of rival power companies or by close working alliances, is a movement that is quite certain to be still further developed in the future.

(3) The decrease in the price of KW.O.—There are here two aspects which must be distinguished. There is the actual cost of production, which inevitably tends to decrease with the increased potentiality of any establishment, and with the economy developed by the improvements in machinery, and still more as the proportion of the power at any time rented as compared to that produced increases. Then there is the price at which power is sold. Signor Omodeo (Il Problema Idraulico) states that companies have often sold under cost of production in order to induce customers to abandon the use of their steam. He states that from 3 to 4 cts. per KW.O. is a price made currently to large establishments, and that it has been sold even below 2 cts. per KW.O., which seems cheap, but we know that in Norway KW.O. is sold at less than ½ ct., and this is the price at which Italian companies should aim. Signor Conti, managing director of the Conti Electrical Co., writing in 1916 (Problema Idraulico, p. 20), says:—"During the past 15 years the mean of the index numbers of the chief necessaries of life has gone up about 50 per cent. On the other hand, the cost of electricity has been in continual diminution. The KW.O. for light, which in 1894 was sold in Milan for L1.40, is now sold at 50 cts., 40 cts., or even 20 cts. For power it could not then be sold for less than 25 cts., but is now currently sold to large consumers for 6 and 5 cts., and in some special cases for even less than 1 ct."

(4) The German invasion of the electrical industry in Italy marched to victory under two flags, one blazoned B.C.I., the other V.D.E. The work of the B.C.I. has already been referred to. The Banca Commerciale Italiana was concerned mainly with the finance of the enterprise, and managed to secure for its German patrons a controlling interest in a large number of Italian electrical power industries —the "key" industries of new Italy.

The V.D.E. worked on different, more insidious, but quite as useful lines. V.D.E. stands for Verband Deutscher Electrotechniker, the German association which formed a body of rules for the construction and use of electrical machinery, cables, &c., which were intended to form a basis for the purchase of machinery, and to safeguard the men who used it. In Italy, as in Germany, these rules have been accepted as binding in the industry, and in contracts for the building, the sale, or passing by the expert of any piece of machinery, a proviso is inserted that it shall be in accordance with the rules and formula of the V.D.E. Though it is hoped to substitute A.E.I. (Associatione Elettrica Italiana) for V.D.E., this has not yet been done, and the German formulæ still hold the field, or, at least, did so till after the declaration of war.

It is very exceptional in Italy to find any reference in contracts to the formulæ of the American, English, or Swiss Associations. The prestige attaching to the machinery made in the country which had originated these rules and monogram counted for much, but the powerful firms, Siemens-Schuckert and A.E.G., did not fail to make use of the influence they had over the men of science. "When I have carried out a scheme of conquest," said Frederic the Great, "I shall always find a pedant who will provide a justification." So these big firms, when they found it necessary to sell their surplus product abroad, used the "pedants" of the V.D.E. to facilitate the invasion of Italy by modifying their formulæ to suit the object in view, which was the sale of lighter and cheaper stuff at the higher price, a bit of statecraft which could be justified by a manipulation of these formulæ. The advantage of selling the lighter machinery was twofold: it cost less to build, and, inasmuch as the Italian duty is collected according to weight, and not *ad valorem*, it paid a smaller duty. "One of the points with regard to which there was much uncertainty," writes Signor Semenza, "was the definition of the power of any electrical machine: what was really meant by a dynamo of 100 KW. or a motor of 100 H.P.? The skilful modification of a few carefully-selected formulæ was sufficient to enable a machine, which had previously been classed as of 100 KW., to be labelled 120 KW."

Thus it came about that, backed by the prestige which attached to all products of German "kultur," and by the help of B.C.I. and V.D.E., the German manufacturers were able to sweep the Italian market, and not only to sell their own produce to meet the increasing demand for electrical machinery, but also to starve out native firms, with the result that of the 18 firms which exhibited at Como in 1899, very few now survive.

It is impossible from the statistics of the Italian Custom House to discover what is the German importation of electrical machinery, as much of it comes in as "partly manufactured goods," in order to be entered at a lower scale of duty, and the classification of the Custom House does not always distinguish between electrical and other machinery. Allowance must be made for this in estimating the apparent decrease of importation of electrical machinery from Germany into Italy. It seems possible, though there is no proof of this, that the Germans took more advantage of the regulations enabling them to introduce their unfinished machines as "ironwork." Moreover, the diminution in weight of the individual machines referred to in what has been written about the V.D.E. must be allowed for in estimating the number of machines as compared to the total weight imported.

The *Elettricita* of Milan, March, 1910, referring to the returns of imports and exports for 1909, states that "During the year 1909 there were imported, of machines exceeding one ton in weight, 43,000 quintals; during the year 1908, 53,000 quintals. The decrease was in German machines, which dropped from 36,000 quintals, while Switzerland gained 2,000 quintals, importing altogether 8,000 quintals.

"Of machines under one ton, Italy bought 30,000 quintals in 1908, against 24,000 quintals in 1909. Of these, 23,000 quintals in 1908, and 17,000 quintals in 1909 came from Germany. The quantity of new electrical machinery installed in Italy each year is probably stationary, but Germany has lost to the advantage of Italian manufacturers and those of other countries, especially Switzerland."

It would seem that, though the Central Powers are predominant, their monopoly is not so complete as it was. But against this it must be observed that some at least of the Swiss manufacturers are closely linked up with the German banking groups, the A.E.G., Brown, Boveri, &c.; and that several of the Italian firms are merely German emanations which do their work in Italy to avoid Customs regulations, while their control comes from, and their profits go to, Germany.

Steel Transmissions in the States.—The Pacific Coast companies are giving considerable attention to the use of steel in place of copper for transmission lines. Steel conductors not only effect a saving due to reduced cost per unit of length, but also because of the longer spans permissible.

Standard spans of 350 ft., with No. 6 or No. 4 solid, and 450 ft. with No. 2 or No. 1 stranded copper, have been used extensively in the past; with the introduction of steel a 700-ft. span was selected as standard, and many miles of line have been built with spans of this length. The spans necessitate large sags, and the old style triangular construction, with pole-top pin, has been adopted, to give greater clearances between conductors.

Owing to the greater strains, more careful guying is required at corners, and at sharp corners four or six anchors to the pole are occasionally required. The San Diego Co. has now installed in main or branch lines, exceeding a mile in length, 201 wire miles of $\frac{1}{4}$ in., $\frac{5}{16}$ in. or $\frac{3}{8}$ in. standard steel; 75 wire miles are under construction, and there are 52 wire miles of $\frac{1}{2}$-in. steel in constant-current series circuits.

Most of the constant-pressure circuits are at 11,000 volts, though a few are at 2,300 volts.

A recent issue (Vol. LXXI, No. 2) of the *Electrical World* contains a summary of the specification used in a recent 11-mile extension. The conductor was of $\frac{3}{8}$-in. extra-galvanised seven-strand standard steel. The normal 700-ft. span to vary according to the country; maximum single-pole spans to be 1,000 ft.; spans exceeding 1,000 ft. to terminate on double-pole structures; high-strength steel to be used for spans exceeding 1,500 ft.; 200-ft. spans, where possible, in crossing railways, highways and telephone lines. Clearances:—Railway, 28 ft.; high-roads, 24 ft.; other supply or communication lines, 6 ft. Standard pole length:—Tangents, 40 ft.; corners, 45 ft. Poles set in concrete in heavy marshes:—Trussed poles set in concrete or push-brace where anchors cannot be placed. Triangular wire arrangement with six-mile barrel transpositions, unless by special agreement.

NOMENCLATURE.

Continuous Current *versus* Direct Current, and Voltage *versus* Pressure.

By A. P. TROTTER.

In 1909 the Nomenclature Committee was appointed by the British National Committee of the International Electrotechnical Commission, to consider and to draft definitions of the electrotechnical terms in use in the English Language. The Committee consisted of Dr. S. P. Thompson, W. Duddell, Dr. A. Russell, R. Hammond, H. W. Miller, F. H. Nalder, C. H. Wordingham, R. W. Hammond, A. Siemens, C. le Maistre (secretary), and myself (chairman). The bulk of the work was done by the first four or five members named.

The object of the Committee was to record the usage of terms, to decide which of two or more terms of identical, or nearly identical, connotation had the best claim for recognition, to draft definitions as concisely as possible, and, having regard to the International character of the work, to avoid idioms, and to promote concord with foreign terms and their definitions. New terms are sometimes invented to express new ideas. It was not the business of the Committee to look for new ideas. They found that there were considerably more terms than ideas, and that the use of some of the former might be discouraged.

A list of terms from A to E was issued during 1910, and Committees in Denmark, France, Germany, Italy, and Mexico were soon at work. In 1914, the British Committee having revised their first section, completed their list, and it is interesting to note that they were so impressed by the lucidity of the drafting of some eight or nine of the Danish definitions, that they adopted translations of these. Alphabetical arrangement was not philosophical enough for the Germans, and they delayed the work considerably, for the British Committee turned aside to examine their proposals, which included such terms as *Leistungsschild*, a Name-plate. Something might be said about settling the legend to be put on the name-plate, but that was work for another Committee. The next word on their list was *Lieferungsbedingungen*, and when this barbarous noise is translated, it falls to pieces into Conditions of Delivery (tender). The Committee did not think they were called upon to define what these conditions should be, and what the Germans proposed to do with it was not clear.

In an introduction to the British list which was published in the *Journal* of the Institution of Electrical Engineers, Vol. LII, No. 233, and which is reprinted, and may be obtained separately, they asked that the list which they presented should not be taken as final, as they were aware that there was considerable difference of opinion on the exact meaning and interpretation of some of the words, and they hoped that suggestions would be sent through the Secretary of the Institution of Electrical Engineers which might eliminate errors and set up standard definitions to be finally accepted in this country.

Some of the terms considered are used only in electrical science, others only in engineering, and not a few were found which the Committee decided to discourage, *e.g.*, Alternation, for Half a Period; Magnetic Resistance, for Magnetic Reluctance; Effective Ampere and Volt, for Virtual Ampere and Volt. Some terms, such as Nominal Horse Power, Voltaic Cell, and Tension (when used alone) were declared to be obsolete. The Committee anticipated that material divergence between British and American usage existed, but very few cases were found, and most of these were unimportant, *e.g.*, the Carcase of a dynamo, alternator, or motor is called the Body in U.S.; a Choking Coil is a Reactance Coil or Kicking Coil; a Period is a Cycle; Earth is Ground; a Feeder Box is a Junction Box. One term alone demanded careful attention, namely, Continuous Current, which is commonly called Direct Current in U.S.

Neither Faraday nor Maxwell used the expressions Continuous Current and Alternating Current. Many of the terms of physics are derived from the French. In the seventies of the last century the best text-books of general physics were Deschanel and Ganot, translated, and Jamin's Cours de Physique. *Courant continu* was, and always is, used in French, *corrente continua* in Italian. Curiously enough, *corriente continua* appears in the Mexican definition of the overload of a generator, and is immediately followed by *corriente directa* in the overload of a motor. The Danish *Jævenstroms* does not help us much.

The expression Continuous Current was invariably used both by scientific men and by engineers in this country until the term Direct Current was introduced from the United States. In the great controversy between advocates of continuous current and of alternating current 25 years ago, before the advent of the three-phase motor, Direct Current was never mentioned. An hour or two spent among the back numbers of technical journals might reveal the date when it first appeared. (I once found the date, almost the page where the decimal comma was introduced into French literature, instead of the older decimal point which we use.) In 1895 Ward Leonard wrote of continuous current, and Mr. Hobart has used it habitually, and his book on Continuous-Current Dynamo Design is well known.

There can be no doubt that the reason for the growing use of Direct Current in this country is the concomitant use of the contraction D.C. Many men refuse to employ the contractions E.M.F. or P.D., of which Prof. Ayrton was fond, but they have the words Pressure, Voltage, or "the volts" readily to hand. Perhaps life is not long enough for Continuous Current and Alternating Current. There is a class of engineer who talks of C.B., meaning Circuit Breaker, and E.H.T. for Extra-High-Tension, and of S.P. and D.P. switches. Even mathematicians write R.M.S. for root mean square, and K.V.A. for kilo-volt-ampere. The contraction C.C. is very seldom used for Continuous Current. There would be no confusion with c.c. meaning cubic centimetres. There is no reason that D.C. should not be employed, seeing that we use P.M. meaning afternoon and lb. and oz. for pounds and ounces.

This matter was carefully discussed in Committee, as I well remember, when Dr. S. P. Thompson and Mr. Duddell were present, and we agreed that the standard British usage was Continuous Current. We defined it as an electric current in one direction, and sensibly steady or free from pulsation. We suggested the abbreviation C.C., and, in so doing, we no doubt exceeded our general principle of recording the usage of the day. We added "the term Direct Current is not recommended. (The term Direct Current is much used in U.S.)"

Before arriving at this decision we corresponded about this and other terms with representative men in the United States. I, at all events, was rather surprised to learn that they were by no means unanimous about Direct Current, and that some of them would be glad if Continuous Current were adopted. I am writing of the year 1909, and I admit that Direct Current has become much more common here during the last nine years.

The Committee took into consideration, for what it was worth, the official use of Continuous Current in Board of Trade Regulations. It is safe to say that when these were first drafted the expression Direct Current was almost unknown over here. But Major Cardew had definite views about it, and I have no doubt that he consulted Sir Courtenay Boyle, an excellent scholar, who delighted in philology and accurate use of language, who took so keen an interest in electrical engineering, and was always ready to help. Major Cardew had to classify systems, and to recommend them for the approval of the Board of Trade. Until 1906 a separate description was drafted and approved for each undertaking. An electrical supply through a simple circuit from the dynamo to the lamp appealed to him as a direct supply, while in the case of alternating current the house transformer (for in those days each house was so provided) interrupted the circuit, and the lamp connected to the secondary was said to receive an indirect supply. These terms, direct and indirect, were always used for official purposes of description of systems, *e.g.*, "A continuous current direct supply at low pressure," and it is not surprising that he adhered to the common use of the term Continuous Current, notwithstanding the fact that the Brush and the Thomson-Houston machines of those days gave currents by no means "steady or free from pulsation."

I do not write this to justify and uphold the decision of the Committee, but merely to state some of the grounds on which it was based. The merits of the terms themselves are of minor importance, and I will not discuss them. Personally, I have no strong views on this subject. As one of the old school, I generally speak of continuous current, and I do not naturally talk in capital letters, but if some one speaks to me of D.C. and A.C. I would, to be polite, or to humour him, do the same. I have said that the Committee invited criticism, stating that their list of March, 1914, "must not be taken as final." Although I had some interesting correspondence about the A to E list in 1912-13, I am not aware that any suggestions have been made until a few weeks ago, when the use of Continuous Current was challenged. I understand that the B.E.A.M.A. have circularised their members, and have a big majority in favour of Direct Current. I am not surprised at that. This is still a free country, and anybody may use what terms he likes. Agreement only becomes desirable when Reports or Rules are drawn up by a body like the Engineering Standards Committee. The term Continuous Current was used in the Standardisation Rules which were agreed to by the B.E.A.M.A. two years ago, and the proposal for a change to Direct Current was only once alluded to in the course of the Anglo-American Conference held at the end of last year; so that I am surprised to learn that there is something in the nature of a demand for an immediate change, and "a decision to be reached fairly soon." Possibly the time has come for the change, but there is no reason for rushing it through. The chief reason for retaining the old term Continuous Current is agreement with the French, Italian, and Spanish usage.

Another matter is being raised—a very old one, which never has been settled, and which I do not think needs settling. Electrical science has a collection or choice of terms connoting that which we measure with a voltmeter, namely, Difference of Potential, D.P.; Electromotive Force, E.M.F.; Pressure, Volts, and, when qualified by High or Low, the obsolete term Tension. I do not remember seeing a clear distinction made between difference of potential and electromotive force in any of the older textbooks. I venture to think that even a few modern students would be puzzled to explain in terms of difference of potential what happens when a series of, say, ten cells, each giving one volt and having an internal resistance of one ohm, is short-circuited.

When the original Board of Trade Regulations were drawn up the expression Voltage had hardly appeared, and, if used, was probably regarded as slang. Major Cardew knew the difference between difference of potential and electromotive force. He needed a term for the latter, and, like many scientific men (Maxwell excepted*), the expression electromotive force did not appeal to him. Even if in the modern sense it can be called electromotive, and if from Maxwell's point of view it can properly be called force, the term is a mouthful, and savours of pedantry; so the word Pressure was officially adopted. Of course, there were and are obvious objections to it, but few of us seriously worry about them. The use of the term Voltage has of late largely extended, but more among engineers than among scientific writers. Originally it was used in a descriptive sense, as in speaking of the voltage of a certain lamp, as we speak of the acreage of a field, the mileage of a railway, or the tonnage of a ship. "The Volts" is an expression often used, and Pressure, Voltage, and "the Volts" are not quite synonymous. The official use of the expression Pressure need not count for much. Any old moth-eaten term is good enough for our present electrical legislation. Who dreams of talking about "the electrical quantity contained in a supply," or would tolerate the fatuous legal definition of an Electric Line or of a Street in the Act of 1882?

I tried to induce Dr. Silvanus Thompson to write a paper on the work of the Nomenclature Committee, to explain its aims and methods, to describe its difficulties, to give reasons for its choices and definitions, while these were fresh in his mind, and to invite criticisms and help. Some of the thousands of electrical engineers who have never heard that such a Committee existed, and who have never seen a copy of their work, might have been interested.

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* "Electricity and Magnetism." Vol. II. page 196.

As soon as I was appointed to serve on the Committee I put together a list of about 150 terms and definitions, as something to start upon. On turning over this list I find a few which were left over.

Assistant.—The man who does the work and takes the blame, if any.

Board of Trade.—Usual abbreviation for the Right Honourable the Lords of the Committee of His Majesty's Privy Council appointed for the Consideration of Matters relating to Trade and Foreign Plantations.

Boss.—The man who takes the credit and the profit, if any.

Committee.—An apparatus for concentrating duties on the shoulders of one or two men, who work between the meetings, and distributing the credit for it among those who talk most at the meetings.

THE WORK OF THE ELECTRIC VEHICLE COMMITTEE.

Although it is some little time since a report was issued dealing with the work of the Committee, it must not be inferred therefrom that the latter has ceased its activities. The Committee's efforts have been mainly directed to negotiations with Government Departments with a view to facilitating the extended use of commercial electric vehicles by an increase in home construction, and a modification of import restrictions. It may be mentioned that the maintenance of all electric vehicles in service for utility and national work is strongly supported by H.M. Petroleum Executive on grounds of petrol economy.

The Committee has been in close consultation with the Ministry of Munitions as to fuel economy and upon the question of the allocation of lead for lead-plate batteries. The Committee has obtained a promise from the Munitions Overseas Transport Department to allot shipping space up to a total of six tons per week for the importation from the United States of lead battery plates for electric vehicles. It has been decided to let the battery and vehicle makers apply, with the support of the Committee, within the approved weekly limit of weight, to the respective Government Departments concerned in import and shipping questions in respect of any batteries that may be required.

In July the Committee was requested by the Mechanical Transport Department of the Ministry of Munitions to cooperate in a scheme, proposed by the Director of Mechanical Transport, for getting more electric vehicles put into service with a view to saving petrol, and a concomitant to this scheme was a proposal to provide facilities for the building of electric vehicles in quantities by certain British firms, and the importation of vehicles from the U.S.A. Owing, it is understood, to the increasing stringency of the steel position for war purposes, the contemplated scheme did not admit of adoption.

In some quarters there have been signs of opposition on the part of the motor traders to electric supply authorities taking up the care and charging of electric vehicles, but this has proved to be due to a misunderstanding of the position, which, now that the motor manufacturers and motor traders are represented on the Committee, it is hoped to remove, with resulting harmonious co-operation between all interests. To this end a joint meeting is being arranged of the Council of the Motor Trade Association and the Electric Vehicle Committee.

The Committee's aim has been to make its constitution as completely representative as possible of all interests concerned, and, in accordance therewith, the following members have been added :—

Mr. Goodwin (managing director of C. A. Vandervell and Co., Ltd.), as representative of the Motor Trade Association.

Mr. H. Wyatt, as representing the British Motor & Allied Manufacturers' Association.

Mr. J. P. Kemp, as representative of Agents for Electric Vehicles.

Mr. P. Still, who has been a member of the Committee from its early days, as representative of the Chelsea Electricity Supply Co., now becomes, by the consent of nine out of 13 companies, the representative of London Electricity Supply Companies on the Committee.

New Aluminium Works.—In Norway a new aluminium company has been formed under the style of Nordisk-Aluminium-Industri, with a capital of 1,000,000 kroner: the works, which in every respect are to be fully up-to-date, are to be located at Hinna, and several hundred workmen will be employed.—*Engineering.*

THE FARADAY SOCIETY.

General Discussion on "Electric Furnaces."

The latest general discussion held by the Faraday Society was on "Electric Furnaces," and it took place at the Municipal Technical School, Manchester, on February 14th. Prof. C. A. Edwards, of the University, presided over a large gathering.

The papers and discussion covered a very wide range of subjects, from types of furnaces for attaining high temperatures in the laboratory to the broad principles of furnace design dealt with by Mr. J. Bibby, and including, by the way, such matters as electrodes, transformers, wave forms of impressed voltage, and refractory linings. Special interest, however, attached to the more purely electrical problems that arise in connection with the design and use of these furnaces, and it will be appropriate if we confine this report principally to this aspect of the subject.

By way of introduction it may be said that in spite of the absence of water-power, the number of electric furnaces used in England since the war for manufacturing steel has increased some forty-fold. Mr. Donald F. Campbell emphasised the importance of this progress, which indicates that large deposits of lower grade, more especially phosphoric, ores, until now neglected by the smelter, will be able to be utilised for steel making, and there is no reason why Great Britain should not become, if it is not so already, entirely self-supporting as regards the special steels and ferro-alloys now so essential to the engineer.

It is improbable that the general types of furnaces now in use will materially change. Those chiefly in use in this country are the Héroult, Greaves-Etchells, and the Electro-Metals patterns. The Héroult has three upper electrodes connected to a star or delta group of transformers with the molten bath as an unconnected star point. In the Greaves-Etchells the hearth, made specially thick for the purpose, is connected as one leg of a star connection. The Electro-Metals furnace connects each group of upper electrodes to one of two phases, and connects the hearth and molten bath as a common neutral. These types are all arc-resistance furnaces. The single-phase Synder furnace, for which is claimed an exceptionally low electrode consumption, is also in use. A plea was put in by Mr. H. Etchells, who generally surveyed the subject, for the greater development of the pure resistance type, which was ideal from the electric load standpoint, on account of its high load power factor and slight fluctuation. The Bailey furnace, in which the resister material consists of broken electrode carbon, granulated coke, and suchlike materials disposed in an open trough encircling the interior hearth, was a furnace of this type coming into considerable use in the United States for re-heating and annealing purposes. As far as this country is concerned, it did not appear from the discussion that any great development in the use of induction furnaces was to be expected. Apart from their low power factor—which calls for very cheap hydro-electric power—their principal use is for melting exceptionally pure scrap, such as is not here generally available. On the other hand, their value for melting the non-ferrous metals does not seem to have been sufficiently considered.

It is interesting to note that the capacity of the largest units of steel-melting furnaces now made—only some 30 tons, even in exceptional cases—is not considered likely to be exceeded in the future, as the limiting efficiency seems almost to have been attained, unless some very radical alteration in design is made. The question of electrodes, always a troublesome one, begins to present serious difficulties with the big furnaces carrying, say, 20,000 amperes, for half this current is as much as any electrode will at present carry. The problem is solved by having multiple electrodes, but the application of the usual three-phase current to, say, a furnace with four electrodes presents obvious electrical difficulties. Mr. Bibby has very ingeniously got over these difficulties.

Whatever system is adopted, it must be such that when equal currents are flowing through each of the arcs, then equal currents must be taken from each of the three high-tension mains, and each of these three primary currents must be practically in phase with its voltage in order to secure a high power factor. Further, to ensure circulation of the molten metal, it is desirable that a certain amount of current should flow vertically through the hearth to a fifth fixed electrode beneath it. Some system is therefore required which will impress an equal voltage between each upper electrode and the hearth electrode, so that when equally adjusted equal currents, and therefore four equal heating zones, will be obtained.

The condition is met if we can obtain on the furnace side of the transformers four equal phases, one for each electrode and a common return to a neutral electrode beneath the hearth. In short, we require a 4-phase, 5-wire system. Thi can be obtained by simply having two sets of two phase working in parallel, but this system has serious electrica objections, and the problem has been solved in another wa by the Electro-Metals 4-phase arrangement, which consist of three single-phase transformers. Two of these trans formers have their terminals connected separately to the fou upper electrodes. A tapping is taken from the middle of th third or Teaser transformer to the hearth electrode, and th ninals of the Teaser transformer are connected to interliate tappings on the main transformers. A closed system hus obtained when arcs are struck between the four upper trodes and the bath of metal. This system gives an equal age in each of the arcs, and therefore equal heating zones, also when the electrodes are regulated for equal currents, n equal currents are taken from the three primary mains. average power factor of the system on a non-inductive l is unity. Further advantages of the system are that en the furnace is under poor regulation the primary curts remain tolerably balanced with a high power factor. he important matter of methods of controlling electric fures was dealt with by Messrs. A. P. M. Fleming and F. E. L, who classified in a systematic manner the various hods in use. In practically all furnaces a certain amount auxiliary control is obtained by raising or lowering the trodes, either by hand or automatically. But the wider ge of control that is usually necessary can only be obed by varying the applied voltage on the furnace terals. The following five methods of doing so were described illustrated :—

Alteration of the ratio of the main transformer by cut- out a portion of the primary winding.

Alteration of the ratio of the main transformer by an iliary winding which can be connected up in series with n opposition to the main winding.

Use of a primary booster transformer to vary the second- voltage by altering the pressure supplied to the primary.

Use of a secondary booster transformer, the secondary which is in series with the main secondary, the booster nary being in parallel with the main primary.

Control by means of a motor-generator; a method rarely l.

everal speakers, following Mr. Bibby, discussed in an resting manner the general principles underlying electric ace design and operation. Mr. R. G. M. Mercer, coming tudy the subject with no preconceived ideas, gave it as impression that electric furnaces were operated too much they were Siemens open-hearth furnaces. In particular, criticised the wide doors, usually open at the bottom, and large electrode spaces at the top, both of which tended educe efficiency and increase electrode consumption. As he latter point, certain economisers were now in use h effected a 20 to 30 per cent. saving of electrodes. Prof. G. Fearnsides considered that on the mechanical side we only arrived at the A B C of furnace design. His stricts referred more particularly to the mechanical strain on ctory linings and electrodes in the usual pattern of tilt- furnace.

general impression one gathered from the discussion was limitation placed on the possibilities of electric furnace lopment by the want of a really first-class refractory rial, particularly for the roof of the furnace. The genius e electric furnace lay in its power of concentrating an mous amount of heat in one confined area—precisely e the metallurgist wanted it, and it was the refractory limited electric heating being used to the greatest advan- Silica bricks as used at present for roof-vaults were up to a point, but they were limited not only by temture, but by corrosive action in the case of basic ores. fractories—perhaps magnesite or zirconia—fused elecly at temperatures much above that they would have and in position probably offered the best way of meet- these difficulties, but at present the question of cost d the way of progress. The need for extended investiga- in this direction is paramount.

LEGAL.

Marconi Imperial Wireless Chain Litigation.

e King's Bench Division on Thursday, March 14th, the ment between the Postmaster-General and Marconi's less Telegraph Co., Ltd., for the construction of a chain reless stations came before Mr. Justice McCardie in the of a petition by the company for a declaration that the aster-General was not entitled to repudiate the agree , and for damages.

insel for the company were Sir Edward Carson, K.C., Mr. Leslie Scott, K.C., M.P., Mr. Geo. Wallace K.C., Mr. Stuart Beavan, and for the Postmaster-General counere the Attorney-General (Sir F. E Smith, K.C.), the tor-General (Sir Gordon Hewart), Mr. A. C. Walter, Mr. G. Branson, and Mr. Harold Smith.

Edward Carson, for the Marconi Co., said that they iled a petition making a claim for a declaration that Postmaster-General was not entitled to repudiate an ment of July 30th, 1913, and that the said agreement wrongfully repudiated by him, and then a declaration the suppliants should be entitled to damages and ich other relief as might be necessary. Under agreement the suppliants contracted to provide and uct six long-distance stations in England, Egypt, the African Protectorate, the Union of South Africa, India, Singapore. As regarded the first three of these stations land, Egypt, and East Africa—the contract was to be an absolute contract, but as regarded the second three stations —the Union of South Africa, India, and Singapore—there was in the contract a right to the Postmaster-General, by giving notice at any time up to the completion, to cancel that operation of the contract, and to pay out-of-pocket expenses without other compensation. The agreement was duly confirmed by a resolution of the House of Commons passed on August 8th, 1913, and as regarded the installations in the Union of South Africa, Egypt, and India by the Governments of those places, and by the Secretary of State for India in Council. No notice was at any time given by the Postmaster-General of his cancellation of such part of the agreement as related to the establishment and installation of the stations in the Union of South Africa, India, or Singapore. On the contrary, the company said that in the case of the Indian station, the Postmaster-General decided, on or about May, 1914, that such station should be proceeded with in the first instance, and so informed the suppliants, who agreed to proceed with the same. The company had at all times been ready and willing to proceed to carry out the installations between August, 1913, and December, 1914. On December 31st, 1914, a letter from the Secretary to the Post Office repudiated the agreement, and refused to allow the company to proceed further with the installations. On August 21st the Postmaster-General paid a sum of £62,000 on account of expenditure incurred. The company said that they had been greatly damaged by being deprived of all the royalties which they would have earned under the agreement, and that they had lost the whole of the moneys expended. If the Post Office had repudiated the contract the company would be entitled to damages, for they had never refused, in fact they were always pressing, to go on with the contract, and to get the necessary information and direction to go on. On January 11th, 1915, the company wrote claiming compensation for the alleged abandonment of the agreement by the Postmaster-General, and the latter thereupon by letter of January 21st, 1915, withdrew his letter of December 30th, 1914, and offered to co-operate with the company in carrying out the terms of the existing agreement with all possible promptitude.

With regard to this letter, Sir Edward said his contention would be that, upon the facts of this case, that was an unreasonable offer under the circumstances, and one which they were not bound to accept, and one, indeed, which it would have been impossible to accept. He maintained that his clients acted with reason in refusing to have anything further to do with the contract after the letter of December 30th. Having related the history of matters up to the approval of the contract by the House of Commons, Sir Edward said that if ever there was a contract over which care was taken that the Post Office should not incur the displeasure of the House of Commons or anybody else, it was this contract, and the extraordinary thing was that, after all the precautions taken and all the urgency, none of these stations had up to the present time been erected. The company had since 1912 been treated as regarded their contract in a manner in which, he submitted, no commercial firms would treat each other. It was now six years since the first of these contracts was entered into, and the company was now solemnly told, after all the expense that it had been put to, that it had no claim for damages.

Sir Edward then proceeded to read the correspondence, which was voluminous, and, in course of the reading, remarked that the company was astonished one morning to find an advertisement in most of the newspapers inviting applications to tender for the construction of the second three high-power wireless stations of the Imperial chain from any wireless company, syndicate, or contractors who were able, by means of practical demonstration, to satisfy the Postmaster-General of the efficiency of their system.

That was done, Sir Edward proceeded, without a word to the company, who considered the action of the Postmaster-General almost incredible. The chairman of the company (Mr. Isaacs) wrote pointing out that a more damaging statement to the company it would be impossible to imagine, having regard to what had taken place in the House of Commons and the country. There was, said Sir Edward, something at the back of the action of the Government all through in relation to this. Mr. Samuel, in reply to that letter, assured Mr. Isaacs that the announcement in the newspapers was merely to satisfy demands made in the House of Commons, that no replies had been received, and that they were all aware that no such demonstrations as were asked for could be given, and that a statement should be inserted in the Press to remove the impression created by the announcement, and he hoped to give instructions shortly to proceed with the erection of all six stations, subject to ratification by South Africa.

On Friday Sir Edward Carson continued the reading of the correspondence. He said that in June, 1914, Mr. Isaacs, in Paris, learnt to his astonishment that the Postmaster-General (Sir Charles Hobhouse) and Sir Henry Norman, M.P., had been to Berlin, and tried to induce the Telefunken Co. to compete in England with the Marconi Co. in connection with the contract; Mr. Isaacs subsequently received from the directors of the Telefunken Co. a signed statement to this effect, and on November 6th communicated the facts to Mr. Murray, the then Secretary to the Post Office, who undertook to report his complaint to the Postmaster-General. In February, 1915, said Sir Edward, Mr Isaacs had an interview with Sir Charles Hobhouse, at which Sir Charles ted that he had gone to the Telefunken Co. and that, looking back, he thought that was a mistake on his part, having regard to his relations with the Marconi Co. On June 28th, 1916, Mr. Pease (then Postmaster-General, and now Lord Gainford) informed Mr. Isaacs that Sir Chas. Hobhouse said there was no foundation for the statement contained in the letter of the Telefunken Co., and that both he and Sir Henry Norman were much incensed at such libellous statements in any letter. In reply, Mr. Isaacs wrote on June 29th, 1916, expressing his astonishment at Sir Chas. Hobhouse's denial of the statement contained in the letter, and pointing out that since he reported the matter to Mr. Murray, on November 6th, 1914, neither Sir Chas. Hobhouse nor Sir Henry Norman had repudiated the statement. On the contrary, early in 1915, Sir Chas. Hobhouse sought an interview with him (Mr. Isaacs), and on two occasions admitted that he did make the offer in question to the Telefunken Co., and that he had since recognised that he should not have done so. "He pointed out that I had my foot on his neck. Did I intend to crush him, which would necessitate his leaving the Government, or would I be disposed to help him?" Mr. Isaacs told him that if a settlement of the contract could be made there would be no reason for the letter to be disclosed, and Sir Charles said he would do his best to bring about an equitable settlement. As a result, the negotiations with the Admiralty were opened. Sir Edward Carson read a translation of the Telefunken letter, which stated that the Postmaster-General and Sir Henry Norman had promised the support of the Government to the Telefunken Co., provided that the latter made offers lower than the Wireless Co.; but the Telefunken could not do this, and therefore Sir Henry Norman approached Herr von Lepel with the object of encouraging him to form an English company. Sir Edward considered the letter of great importance as throwing light on the delays which took place.

Sir F. E. Smith stated that Sir Chas. Hobhouse gave a most specific and positive denial to the statements of fact contained in the Telefunken letter.

After further argument, Sir Edward submitted that the company was entitled to a declaration that the Postmaster-General was not entitled to repudiate the agreement, and that there must be an inquiry to assess damages. He submitted that that assessment should be on the basis of six stations, and should be calculated without any reference to the letter of January 21st.

Sir F. E. Smith (Attorney-General), intervening, said that he and his learned friend the Solicitor-General had taken throughout the view that it was extremely difficult for the Government to contend that there had not been a breach of the contract, for which the Government was responsible. The person who ultimately determined the amount of the compensation should not have his discretion fettered, and therefore the letter of January 21st was for this purpose to be treated as not having been written. Whatever was the real legal situation, in assessing this compensation the basis of compensation should be six stations, and not three.

Mr. Justice McCardie: I think the Crown are acting with great propriety in taking the course which has been announced by the Attorney-General. In my view, that which has taken place in Court will be of the greatest possible utility to the gentleman who has to determine the question of damages. There will be first a declaration that the Postmaster-General was not entitled to repudiate the agreement of July 30th, 1913, and that such agreement in December, 1914, was wrongly repudiated. It will follow upon that declaration that the petitioners are entitled to have damages assessed. It is agreed, as I understand, that the letter of January 21st, 1915, has no juristic relevance to the points which will arise before the tribunal set up to assess damages. It is further agreed between the Crown and the petitioners that the basis on which damages shall be assessed will be that the six stations would have been completed under the contract of July 30th, 1913. Damages will be assessed by some competent expert in a manner which will be agreed between the parties.

His Lordship granted an order for costs.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

In the House of Lords, on 18th inst., a considered judgment was given in the appeal by the British Thomson-Houston Co., Ltd., against an order of the Court of Appeal, which affirmed a judgment of Mr. Justice Astbury.

The arguments were unusually lengthy. Before the trial judge they lasted 10 days, in the Court of Appeal five days, and in their Lordships' House 12 days. The trial was reported in our issues of December 8th, 1916, *et seq.*, and the proceedings in the Court of Appeal in March, 1917.

Mr. A. J. Walter, K.C., Mr. Colefax, K.C., and Mr. Gray appeared in support of the appeal; Mr. Thomas Terrell, K.C., Mr. Kerly, K.C., and Mr. Courtney Terrell for the respondents.

Their Lordships, after consideration, dismissed the appeal, Lord Dunedin dissenting.

The Lord Chancellor, in the course of his judgment, said that the action was brought for alleged infringement of a patent (No. 21,513) of 1906 for the treatment and working of metallic tungsten. The question was the validity of that patent, and turned upon Claim 1, which stated that the patentees claimed "the method of working tungsten whicl consists in subjecting the metal in a coherent form to th action of heat while it is being operated on or manipulated." It was asserted by the appellants that under Claim 1 the were entitled to the exclusive use of tungsten rendered duc tile and malleable by this process of theirs for the purpos of working it in the manner described in that claim. Hi Lordship said: "In my opinion the words 'in a coheren form' in Claim 1 cannot be read as denoting tungsten ol tained by the appellants' preparatory process or its equiva lent. It was upon this first point that the appellants chiefl relied, as showing subject matter. In my opinion it fail and the first claim is, on its true construction, one for sul jecting any form of the coherent metal to the influence c heat while it is being operated on or manipulated. The appe lants, however, further assert that the application of hea especially (as they put it) of continuous heat during the pr cess of working, showed invention, and was good subjec matter for a patent. A good deal of evidence was given bea ing on this point, and the result is to show that workin under heat was the most familiar mode of working metal It was suggested that the heat so applied was not continuou but it is obvious that the heat was always renewed as soc as the metal approached the temperature at which it woul no longer be workable, and for all practical purposes th amounts to the application of continuous heat. There can be n subject-matter in the application to tungsten of the old pr cess of working under heat, as this does not require a invention. . . . As on my construction of the first clai the use of tungsten in the form produced by the preparato operation described on page 4, lines 25-35, is not claimed, is unnecessary to consider whether the process so describ was novel, and such as would have supported any pate based upon it. . . . In my opinion the appeal fails."

Lord Dunedin, in differing from the opinion expressed the Lord Chancellor, referred to the evidence given as what was the state of common knowledge when the pate was applied for, and said that at that date it was not with common knowledge to indicate any way of drawing tungst wire to form filaments for electric lamps. The claim was no as he read it, a claim for the application of heat to tungste it was for a process as a whole. He was persuaded that t patentee had made a valuable discovery, and that his clai was so framed as to cover that discovery. Admittedly t industry had practically proceeded on these lines, and the lines alone. He regretted that the judgment to be pronounc would deprive the inventor of the fruits of his ingenuity. F these reasons he thought that the appeal should have su ceeded.

Lords Atkinson and Shaw read judgments agreeing wi the Lord Chancellor that the appeal should be dismissed.

By a majority, therefore, the appeal was dismissed wi costs.

Sulley v. Withers.

In the Lord Mayor's Court, before the Recorder (Sir Forr Fulton, K.C.), this case was again in the list by way of motion. It was before the Court a month ago (Elec. Re February 22nd, p. 177). The case now came before the Co by way of a motion for a new trial.

Mr. Merlin, for the defendant, said that the case had b settled on terms agreed between the parties.

Mr. Morle, for the plaintiff, said his Lordship would member that the plaintiff, an auctioneer, sued to recover amount of a cheque given by the defendant, a custom Charges of fraud were made against the plaintiff, and wh those charges remained on record no settlement could arrived at. The defendant had consented to withdraw imputations, and under those circumstances they had agr to terms by which the debt and costs would be satisfied instalments. It was not necessary to trouble his Lords with those terms. A judge's order would be obtained, necessary.

His Lordship concurred in the settlement.

Bennett v. Edey.

In the Bow County Court, before his Honour Judge Grah K.C., C. B. Bennett, of Sydenham, electrical goods dea sued F. G. Edey, of Upton Park, also a dealer in electr goods, to recover £13 6s. 9d. for goods supplied.

Mr. Harris said £11 12s. 3d. had been paid into court, the only question was as to the balance, £1 14s. 6d., wh represented 46 alleged faulty Baby torch refills retained the defendant. When the goods were delivered the batte were in the box, which was sealed, and everything wa perfect order. It said on the box, "We will replace battery without charge if it depreciates in strength wi 12 months, provided the seal is unbroken." The seals been broken of all those returned by the defendant. If found them wrong, he should have returned the gross purchased *en bloc*. He could have tested the batteries a voltmeter before breaking the seal. He could not ret now as he had not observed the conditions of sale.

The Plaintiff gave evidence, and said it was a well-kn custom of the trade not to break the seals.

The Defendant said he did test the batteries when came in, and at once returned 37 out of the gross. He to break the seals, as he had to put the batteries in the torches, having purchased them complete at 5s. 2d. He was in a hurry for them, too, for his Christmas trade. Those he put in the torches he thought all right, but they were being returned every day by customers, so he decided to return what he had in hand. He was quite certain they were all old ones made up, but this plaintiff denied. Defendant added that the 25 percentage of bad ones at the start was abnormally high; it was usually two or three.

Judge Graham said the defendant should have returned the lot without breaking the seals, and would have to pay, as he had not done so. There would be judgment for the plaintiff for the full amount claimed, and costs.

Osram-Robertson Patents Litigation.

In the Chancery Division on March 15th, before Mr. Justice Neville, Mr. Hunter Gray moved for judgment in default of defence in an action by the Osram-Robertson Lamp Works, Ltd., against the Ostro Light Co. Counsel said that the action was for an injunction in respect of infringement of two letters patent, for delivery up, and for an inquiry as to damages. There was no defence, and he asked for judgment.

His Lordship made an order in the usual form.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coil v. Magneto Ignition.

In the current issue of your journal you report on the increasing number of American automobiles fitted with coil ignition. While I agree that this is mainly due to the fact that nearly all the cars are now supplied with dynamos and batteries for lighting purposes, is it not an established fact that a good system of coil ignition is superior to magneto?

I have not heard a discussion on the subject by electrical engineers or ignition experts, and, if your valuable space permits, I venture to say it would be both interesting and profitable, especially as ignition plays such an important part in the engineering of to-day.

E. G. Ford.

Seven Kings, *March 18th*, 1918.

WAR ITEMS.

Trading with the Enemy.—The *London Gazette* for March 15th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Uruguay, Bolivia, Brazil, Chile, Denmark, Honduras, Mexico, Netherlands, Norway, Spain, and Sweden.

German Coal Shortage.—In the course of an article on "Problems Facing the German People," the *Birmingham Daily Post* quotes information gleaned from the German Press. In regard to coal, the writer says:—"Difficulties arising from the shortage of coal, and consequent new restrictions on consumption, are reported from most of the large towns, including Berlin, Munich, Dresden, Hamburg, Bremen, Stettin, &c. The Imperial Coal Commissary has issued an official intimation that the coal quota for electric works will have to be reduced to 70 per cent. of the intended amount. In Berlin the tramway service has been drastically reduced, and in Munich it has been cut down to one-third. In Dresden and other towns fresh restrictions have been imposed on the use of electric power and electric light. In some towns no gas is supplied during the day, and in others the gasworks have actually had to resort to the use of wood, while complaints of the poor quality of the gas are universal. South Germany continues to be especially poorly provided with coal. Munich, for instance, is receiving only 1,400 tons a day, instead of the promised quota of 2,000, and the Bavarian Press is full of protests against the alleged discrimination practised against Bavaria."

War Loan Subscriptions.—Amongst the electrical and engineering firms who distinguished themselves during "Business Men's War Loan Week," was Callender's Cable and Construction Co., Ltd. The employés at their Anchor Works, Leigh (Lancs.), set out to raise £10,000 towards the Leigh Submarine, and adopted as their motto:—

> As the Anchor is the hope of the Ship, so the Leigh Submarine will be safe if the "Anchor" does its duty.

The result was a total subscription of over £25,000, of which the firm contributed £7,345. The Mayor congratulated the Anchor Works on being the largest subscribers in the town.

Exemption Applications.—At the Shoreditch Tribunal, Messrs. Jeremiah Rotherham & Co., Ltd., appealed for H. Frantzmann, aged 39 years, classed C 3, superintendent electrician, for the second time, on business grounds. The chairman said he believed this to be a certified occupation. Capt. Weber: If he is the only one on the firm it would be so. Capt. Fisher said the man would be looking after the electric lights of this big firm, which was work of importance. The Tribunal granted six months.

At the Shoreditch Tribunal, James Hoyle, ironfounder, appealed for A. T. Hoyle, aged 26 years, grade 3, an ironmoulder, on business grounds. He was stated to be making steel castings for electrical fittings. All electrical work could be considered of national importance at the moment. All the work of the business was on Class A certificates. The applicant had only two men left now. The Tribunal granted six months.

Before the County Appeal Court, the National Service representative appealed against exemption to A. Hunter, a stoker at the Carlisle Corporation electricity works. Major Hope Brown stated that the man had held a protection certificate, but that had been withdrawn. A further application had been made to the Ministry of Munitions by Mr. Purse, but he understood that they had definitely refused to entertain it. In the case of a man who had had a protection certificate withdrawn, the local tribunal ought not to have granted an exemption on occupational grounds. Mr. Purse stated that he had received no direct information from the Ministry of Munitions, and his application was refused, although he had written personally, but he believed that the Ministry could not have appreciated the difficulty that was being experienced in the City, or they would have adopted a different attitude. In reply to the clerk, Mr. Purse said that substitutes would not stay on the works, and they were each paid £3 3s. per week. The Court adjourned the case for further information from the Ministry of Munitions.

At Rochdale, the Corporation Tramways Committee appealed for R. C. Kelsall (27, Class A), driller, but the man was directed to join up forthwith.

At Maidstone, Mr. Oswald Jones, electrical engineer, appealed for exemption for E. Wicks (28) and W. H. Brown (38), electricians. Mr. Vaughan Gower explained that if the two men were doing certain work, they could be protected, and to enable Mr. Jones to make the necessary application the appeals were put back.

At High Wycombe, Mr. H. S. Broom appealed for the retention of J. H. Milner (18), electrical engineer. Exemption was refused, and the calling up suspended for a month.

At Workington, exemption was claimed for an electrician at the blast furnaces (33, Class A), who said that he was working 16 hours per day. Owing to his high category, exemption was refused.

The Reading Tribunal has granted conditional exemption to G. J. Martin (41, B 1), driver on the Corporation tramways.

BUSINESS NOTES.

After-War Electrical Trade and Industrial Banks.—In continuation of its Special Articles extracting parts of the reports of After-the-War Trade Committees, the Board of Trade *Journal* for March 14th publishes notes on the question of financial facilities in regard to the electrical trades. It is stated that while every industry requires for its development the outlay of new capital, that of electrical manufacturing is, perhaps, more dependent than any other on the help of a powerful financial system. "The major part of its activity is connected with enterprises involving heavy expenditure which may not become immediately remunerative, and the concessionaire, inventor, contractor, or manufacturer must, therefore, for such projects as the construction of a new electric railway, the electrification of an existing line, the introduction of new processes and apparatus, or the equipment or extension of a generating or transmission system, have facilities for recourse to financial organisations prepared to stand a temporary lock-up of capital of considerable magnitude." The Electrical Trades Committee state that:—"In Great Britain such facilities do not exist in an adequate degree. Though she is the financial centre of the world, and can claim to be the pioneer in modern engineering, there has never been created any organised co-operation between her finance and her manufacture."

The *Journal* says:—"So far as British joint stock banks are concerned, the Committee consider that their liabilities to the public, large as compared with their capital, forbid their lending, except with a safe margin and on security readily realisable. It is outside the province of such institutions to provide money for an enterprise, whether at home or abroad, involving a heavy and possibly a long immobilisation of funds. In Germany the conditions are totally different. There, a thoroughly-organised alliance, offensive and defensive, has been elaborated between manufacture and finance. Banks and manufacturing concerns have common directors, and on the boards of both there sit technical and commercial experts. The banks link themselves together to provide facilities for industrial expansion, and co-operate with each other and with the great manufacturers in forming subsidiary banks and financial institutions for special purposes. The German financiers do not, at the start, attempt to place an enterprise on the market, as is the practice in England. Guided always by expert advice, they seldom touch a project in itself unsound. They find the money themselves or through their allied groups, and, not afraid of a lock-up of capital, wait till success is shown before they [illegible] the public.

"The attention of the Electrical Trades Committee was drawn to the balance-sheet for the year 1915 of the Allgemeine Electricitäts Gesellshaft, the Siemens-Schuckert Co., and the Bergmann Co., which shows cash balances of 6¼, 2½, and 1½ millions sterling respectively. 'This accumulation of funds,' they consider, 'is recognised as ready and available for peace projects, and the fact emphasises the necessity for financial assistance being at the disposal of British manufacturers.' 'The Electrical Trades Committee is strongly of opinion that the establishment of industrial banks is essential. Such institutions assisted by the advice of expert assessors, would help to protect the public against unsound speculative ventures, and would exercise a profound influence in placing industrial enterprise on a stronger financial basis.' "

Dick, Kerr Turbine Contract for Glasgow.—An important contract for generating plant has recently been awarded to MESSRS. DICK, KERR & CO., LTD., by the Glasgow Corporation in connection with the new power station which is being erected by the city authorities at Dalmarnock. The contract includes a turbo-alternator set, with condensing plant and step-up transformers designed for a continuous output of 18,750 KW. The turbine will be a single unit standard Dick, Kerr impulse type machine, arranged to run at 1,500 R.P.M., and will operate on steam at 250 lb. per sq. in. pressure at the stop valve, superheated to 650° F., and exhaust into a vacuum of 29·1 in. All overloads will be dealt with by automatic governor valves without recourse to hand operation or by-pass valves, high pressures and temperatures being confined to the cast-steel governor valves and inlet castings. The turbine will be direct-coupled to a 6,500-volt, 25-cycle, three-phase Dick, Kerr alternator, having a maximum continuous rating of 24,000 K.V.A. at 80 per cent. power factor. The machine will be of the self-ventilating type, provided with fans on the rotor drawing the cooling air through a wet-air filter of the Heenan & Froude type. An exciter of the overhung type will be provided. The alternator will be electrically connected to a bank of three Westinghouse single-phase, oil-circulated, water-cooled transformers, stepping up the pressure from 6,500 to 20,000 volts. In connection with these transformers, a separate oil cooler and motor-driven oil circulating pumps will be provided. The turbine will exhaust into a standard Willans & Robinson condenser, having a surface of 26,000 sq. ft. The air extraction plant, in duplicate, will be on the well-known Willans rotary water-jet system, which possesses the merit of great simplicity and ease in operation, combined with great evacuation power. The vacuum will be 29·1 in. with a 30-in. barometer. The extraction pumps, also in duplicate, will be of the usual centrifugal type.

Book Notices.—*Aluminium: Facts and Figures.*—In view of the constantly increasing use of aluminium in a wide range of industries and applications, the British Aluminium Co., Ltd., has prepared a new edition of this useful pocket-book, incorporating additional data with regard to various forms of aluminium, and considerably amplifying the "Hints on the Working of Aluminium." The book is bound on the loose-leaf principle to facilitate the addition or substitution of new leaves when necessary. The data relate to a variety of forms ranging from billets to wire and cable, fuse wire, collector bows, bar and strip, sheet, tubes, drawn sections, and castings, and include particulars as to sags and tensions of overhead lines, corona voltages, paper-insulated cables, joints, &c. The special feature of the present issue which we most cordially welcome is the adoption of metric weights and measures "in anticipation of extended trade in countries in which the metric system is exclusively used"; moreover, the data are given in accordance with common sense and with the requirements of commercial practice, in that in no case are more than four significant figures employed. Wire, rod, strip, sheet, and tubes are tabulated in even metric sizes. In the present instance the facts and figures are given in both English and Spanish, in separate sections. The pocket-book, which can be obtained from the company (price 4s.), will be of great use in many quarters of the world.

"Electricity Meters: Their Construction and Management." By C. H. W. Gerhardi. London: Benn Bros., Ltd. Price 15s. net.

"The Theory of Electricity." By G. H. Livens. Cambridge University Press. Price 30s. net.

"Aviation Engines." By Lieutenant V. W. Pagé, U.S. Air Service. London: Crosby Lockwood & Son. Price 15s. net.

For Sale.—King Lynn Corporation Electricity Department has a battery of 220 cells for disposal. For particulars see our advertising pages to-day.

Trade Announcements.—MR. E. C. BEMAN, managing director of the E.S. Co., Ltd., having been refused further exemption, has resigned his seat on the Board and disposed of his entire interest in and terminated his connection with the company, which he founded in 1913. His co-director and fellow shareholder (Mr. Vernon H. Wells) has been for the past 15 months engaged on active service in the R.F.C., and is at present in Mesopotamia. Satisfactory arrangements have been made for the continuance of the business under efficient management.

Messrs. Cunningham, Slater, Ltd., ask us to state that Mr. A. J. Cunningham was the founder of Harraway Bros. and director and secretary to Harraway Bros., Ltd., electrical engineers. Mr. A. J. Cunningham and Mr. J. Wynn Slater have joined forces, and in future the business will be known as CUNNINGHAM, SLATER, LTD., with branches at 45, King's Road, Chelsea, and 146, Kensington High Street, W., the latter being the head depôt and registered offices. All assets and liabilities will be carried over. Mr. Cunningham and Mr. Slater both hold commissions as Lieutenants, the former in the Royal Naval Reserves and the latter in the Army.

The Russo-British Chamber of Commerce has taken new offices at Cross Keys House, 56, Moorgate Street, E.C. 2, the Government having requisitioned its Kingsway premises.

Miners' Safety Lamps.—The Home Secretary has issu
the Safety Lamps Order, dated March 9th, approving of sever
types of Patterson flame safety lamps, the Davis-Briggs oxymet
officials' lamp, and the Joel-Fors electric safety lamp (type 303 M
The specification of the Ceag miners' electric safety lamp
amended and consolidated.

British Industries Fair, 1918.—At the Penningt
Street warehouse of the London Dock, on March 11th, the four
British Industries Fair organised by the Board of Trade since t
outbreak of war was opened. Admission to the Fair is again co
fined to *bonâ fide* trade buyers for home and oversea markets, a
the B. of T. has issued invitations to some 60,000 firms in th
country. As in former years, British firms only are permitted
exhibit, and no manufacturer may exhibit articles other than tho
of his own manufacture. Some 425 firms are exhibiting this yea
and in order to avoid any interference with military requiremen
the Fair has again been confined to the following industries:
Pottery, glass, stationery, paper printing, fancy goods and toy
None of the engineering trades are represented, and the on
electrical exhibits are such articles as pocket lamps, torches, ha
lamps, &c., with dry cells and batteries for the same. Interprete
are in attendance at the offices of the Department, where gener
commercial information can be obtained. The Fair closes to-day.

Calendar.—We have received a large wall calendar fro
the ANGLO-MEXICAN PETROLEUM CO., LTD., of 16, Finsbury Circu
E.C. 2. Monthly slips and complete calendars for 1918 and 19
centre in a design in colour showing oil works and storage and o
applications.

Lady Footballers.—On Saturday last the Lady Foo
ballers connected with the Sterling Athletic and Social Cl
(Sterling Telephone and Electric Co., Ltd.) accomplished one of the
best performances of the season in defeating the previous
undefeated Marconi Ladies, from Chelmsford, by five goals to n
During the season the Sterling Ladies, who are undefeated, ha
scored 78 goals to eight.

Liquidation.—MONOMETER MANUFACTURING CO., LTD.—
Meeting of creditors, March 26th, at 26, Corporation Stre
Birmingham. Liquidators, Messrs. H. T. C. S. Ledsam & G.
Poppleton.

List.—MESSRS. MAVOR & COULSON, LTD., 47, Broa
Street, Mile End, Glasgow.—List of dynamos and motors held
stock for immediate delivery.

Economising High-Speed Steel.—Drawing attention
the imperative necessity for economy in the use of high-speed ste
the MACADAM ELECTRICAL ENGINEERING CO., of 49, Deansgat
Manchester, remarks that great difficulty has been experienced
the manufacturer and the engineer in trying to comply with th
in their own restricted spheres, causing great expense and retar
ation to manufacture. The company states that it is in a positi
to assist them to attain that most desirable object without a
great expenditure, complications in design, or loss of time. Th
can be accomplished with a saving of 75 per cent. of high-spe
steel in practically all tools, simple or complex, at a very sma
outlay.

LIGHTING AND POWER NOTES.

Aberystwyth.—HYDRO-ELECTRIC SCHEME.—The T.C
on March 12th, discussed the question of an electrical supp
for the town, it being proposed to use power from the ri
Rheidol. Ald. T. J. Samuel suggested that they should invi
a first-class electrical engineer to inspect the different sourc
of power available. The matter was adjourned for further co
sideration by the Public Works Committee.

Ammanford.—PRICE INCREASE.—The Electric Supp
Co. has asked the U.D.C. to consent to the charge for electricity
private consumers being advanced by 1d. per unit.

Ardee (Co. Louth).—WORKHOUSE LIGHTING.—Th
Poor Law Guardians have accepted the offer of the Ardee Electr
Co. for the supply of additional lamps in the workhouse.

Bantry.—The Town Commissioners have agreed to p
the contractor for public street lighting an increase of 20 per ce
on pre-war rates.

Bedworth.—STREET LIGHTING.—The Parish Counc
has accepted the offer of the Leicestershire and Warwicksh
Electric Power Co. to light the whole of the street lamps f
12 months at £3 10s. each, 30-C.P. lamps to be used if 50 a
100 C.P. are unobtainable.

Belfast.—EXTENSION SCHEME.—At a special meeting
the Corporation on Friday last, the report of the Tramways a
Electricity Committee, on the proposed extension of the electric
undertaking, was considered. The Committee stated that it receiv
an intimation that Messrs. Workman, Clark & Co. would require
large increase of electric power for their shipyards, and asked if t
Corporation was likely to be able to furnish the supply on su
terms as would make it unnecessary for the firm to install a
further generating plant.

The Committee consulted Sir John Snell, who advised that t

Corporation should give the supply to Messrs. Workman, Clark and Co. If the Corporation declined this responsibility, then it must give up all hope, in his opinion, of developing the undertaking. The power supply to Messrs. Workman & Clark was a critical point in the policy of the electricity department. If the proposed new supply were granted the maximum load would not be less than 12,850 KW., and the plant installed gave a maximum output of 17,300 KW., leaving (on paper) 4,450 KW. spare plant for three classes of supply—traction, general D.C., and the A.C. supplies.

The Corporation would, however, he felt sure, see that there was no alternative policy, and would decide (1) to give the shipyard supply, and (2) to install the necessary additional plant by the autumn of 1919. He would prefer to put the plant into East Bridge Street, but there were difficulties in the way of this project which would, in his mind, eventually mean wasted capital. The alternative was to put both 6,000-KW. sets into a first section of the new harbour station, when many of the present difficulties connected with East Bridge Street would disappear. From an engineering and from a development point of view there was no doubt this was the proper and right policy. But it meant a larger expenditure of capital now, and there would be difficulty in getting steel for the power house building and lead for the extra cables required.

The alternative figures given by Sir John were :—New station on Harbour Estate, £310,750 ; East Bridge Street as altered, £126,000. This scheme would be in substitution for the £60,000 authorised by the Corporation in January last.

The Committee recommends the adoption of the scheme, and also that the services of Sir John Snell as consultant be retained at a fee of 2½ per cent. on the amount of work executed, exclusive of cost of buildings and reinstatement of paving work.

The discussion, which had been twice postponed, lasted two hours, and eventually it was resolved to adopt Sir John Snell's scheme, and application is to be made for sanction to borrow £310,750 for that purpose.—*Northern Whig.*

Birkenhead.—Price Increase.—The T.C. has increased the price of electrical energy as from April 1st as under :—Ordinary consumers for lighting, by a further 12½ per cent. ; prepayment meters, an increase of ½d. per unit ; ordinary power consumers, a further advance of 10 per cent. For the present there is no increase for heating and cooking.

Blackpool.—Price Increase.—The Electricity Supply Department has given notice that, from the commencement of the June quarter, there will be a further increase of 5 per cent. on all electricity accounts.

Continental.—Germany.—A communication to the *Norddeutsche Allgemeine Zeitung* from Munich points out that the main economic problem which will confront Bavaria after the war is the problem of industrialisation. Bavaria possesses little coal but much water power, which has not hitherto been utilised on a large scale. The coal consumption of Bavaria previous to the war was, on an average, ten million tons per annum, and the coal produced in the country only amounted to three million tons. It was, therefore, necessary to import something like seven million tons every year, and it is clear the coal and transport problems would have been much easier during the war had Bavarian water power been fully utilised for the production of electrical energy.

In 1913 the electricity consumption of Bavaria to the right of the Rhine was only 300 million KW.-hours, or less than one-half of that required by the Imperial Nitrate Works alone. This comparison gives an idea of the present extent of the electricity demand of Bavarian industry.

Despite war conditions, the project of the Bavarian Electrical Works put forward some time ago has recently entered upon a critical stage. If this project is realised, the whole of Bavaria to the right of the Rhine will be traversed by transmission networks at a pressure of 100,000 volts, which will be fed by the State—through the projected Walchensee Works and the Lech Works to be established later on—the energy to be purchased by the great Overland Works and the Bavarian towns. During the summer the hydro-electric stations in the south generate more than they can utilise ; they will, therefore, feed the transmission lines, which in turn will distribute to works dependent on coal. In winter the situation will be reversed, and the steam stations — primarily those situated in the neighbourhood of coalfields—will have to supply the deficiency from which the hydro-electric stations suffer as a result of low water.

It is stated that the Bavarian Minister of the Interior is to discuss the plan with the interested parties in the immediate future, and the proposal is to establish the Bavarian Electricity Works as a partly public and partly private undertaking, with a capital of about 30 million marks, half of which will be issued in the form of shares and the rest in bonds. Of the 15 millions the Bavarian State will take over about six million marks, the Overland Works a further three million and the larger towns altogether about three million marks. This Walchensee project, which was first put forward many years ago, will be carried out after the war.

What attitude Bavaria would adopt towards a possible Imperial monopoly of electricity is not known. The Bavarian Minister of the Interior recently stated in the Diet that nothing was known to him "at present" of any intention to introduce an Imperial monopoly, and he declared that Bavaria must in any case reserve the right of disposal over her own water power, and that he intended to exploit this water power as fully and as soon as possible.

Italy.—A deficiency in the supply of electricity furnished by hydro-electric works, arising from the lack of autumnal rains last year, has led the Under-Secretary of State, at a recent public meeting, to announce a number of proposals for the increase of production. Among these is the rapid completion of a number of important hydro-electric schemes in course of construction, the linking-up of electric generating-works in remote regions with the main supply, the reduction of the use of energy for lighting and tramway traction, domestic lighting, and other voluntary uses, and the limitation of supply to various industries to so many days per week. In Piedmont, where these arrangements have been put in practice, the regulations instituted prescribe a seven days' supply of electric current for the lighting and traction services, daily newspapers and munitions factories ; six days' supply to mills, bakeries, steelworks, industrial chemical works, &c. : five days' supply to rubber works, aircraft builders, automobile builders, &c. : four days' supply to engineering works, textile works, carriage builders, bootmakers and military furnishers, sawmills, cabinet making works, printing houses, &c., and three days' supply to film makers, chocolate manufacturers, &c.

Cork.—Electric Tramway and Lighting Co.'s Lease.—At a meeting of the Corporation, the City's Electric Lighting Provisional Order and a report from Mr. J. P. Tierney, M.Inst.C.E., on the present condition of the plant and equipment for the electrical supply of the city were considered.

The City Law Agent (Mr. Galvin) said the lease to the present company (the Electric Tramway and Lighting Co.) for the electric lighting of the city would expire in a few months, and the first question the Corporation had to consider was whether it would be willing to take over the undertaking, or, if not, to ascertain upon what terms the company would be prepared to come to an agreement as to the future. In the report it was stated that the engineer understood that Messrs. H. Ford & Sons (of U.S.A.) contemplated erecting their own power station in their works, and that, as far as information went regarding the size of the works, it would appear that the demand there would be equal to the demand for the whole of the rest of the city. Messrs. Ford had the best site for a power station, because large colliers could come alongside, thereby enabling coal-handling plant to be erected to convey coal direct from the ship's bunkers to the bunkers at the station, while the site was also an admirable one from the point of view of condensing water. The question was one involving a large number of interests, but, taking a broad view of the situation, it seemed to the engineer that it was of the utmost importance to the industrial development of Cork that there should be one large power station situated in the best position for both coal and water, so that, with modern plant, they might be able to generate at a low figure, and to supply at a cheap rate for industrial purposes. Mr. Galvin advised that, in all the circumstances, a small Committee should be appointed to go into all details, and report to the Council.

The suggestion was adopted, and two members from each ward were appointed to form the Committee.

Dartford.—Bulk Supply.—The U.D.C. has given notice to the West Kent Electric Co. that it will not in future supply energy under the contract beyond 600 KW. unless the company agrees to pay as from the date when the maximum of 600 KW. was executed until the termination of the contract certain additional charges. Since October last the demand of the company has been considerably in excess of 600 KW., resulting in an increased loss to the undertaking.

Dover.—Loan.—The T.C. has, instead of borrowing from the bank, utilised the sinking fund as a loan to the electricity undertaking at interest, as if the money were invested.

Dundalk.—Annual Estimates.—The estimate of Mr. P. A. Spalding, engineer and manager to the U.D.C. electricity department, for the ensuing financial year, shows a deficit of £11 after meeting interest and sinking-fund charges on capital loans, and states that, but for anticipated economy in the use of ignition oil, the deficit would have been £800. Mr. Spalding recommends that the contract for town lamps be increased by one-sixth as from April 1st, making a total increase of 33⅓ per cent. on the pre-war contract.

Ebbw Vale.—Strike.—All the electricians of the Ebbw Vale Co. and the Ebbw Vale District Council have struck for higher pay.

Edinburgh.—The Corporation Electric Lighting Committee, on Friday, considered the situation with regard to the position of the proposed power station at Portobello, on which work has been almost suspended since the outbreak of the war. New questions have arisen in connection with the report of the Sub-Committee of the Coal Conservation Committee, which suggests the establishment throughout the country of super-electric power stations to supply the whole kingdom. One of these, it is suggested, might be erected at Newcastle, which would be able to supply the most of Scotland, and thus obviate the necessity of erecting the Portobello station. At Friday's meeting, Sir Alex. Kennedy, who was present, explained matters to the Committee, and it was agreed to instruct him to prepare plans showing the immense possibilities of the Portobello station, and that it fulfils all the requirements of the Coal Conservation Committee for the erection of a big super-station capable of supplying an almost unlimited area, and that this should be submitted direct to the Minister of Munitions, and permission be asked to begin operations on the station.

The Corporation electrical engineer reports that there is now an extra-high-tension converting plant at McDonald Road station, and that with the provision of the necessary switch gear at Dewar Place station he will be able to effect a considerable economy during the four or five summer months. The saving is expected to be over £1,000 a year.

Gillingham (Kent).—Plant Increase.—The T.C. has by 12 votes to 6 rejected a recommendation to install at the electricity works an additional Diesel engine, &c., at an estimated cost of £12,000. The Kent Electric Power Co., who had been approached, had found it impossible to assist the Council in its difficulty by giving a part supply of energy in bulk.

Hereford.—Loan Application. The T.C. has applied to the L.G.B. for sanction to a loan of £9,000 to meet over-expenditure for plant, &c., at the E.L. works, caused by great increases in wages and cost of materials since the first letting of the contracts.

Huddersfield.—The employés at the electricity works have passed a resolution in favour of electricity workers, enginemen, and firemen taking their place in the ranks of organised labour, with an immediate object of asking for an increase of £1 per week over pre-war wages and the 12½ per cent. bonus.

Lourenco Marques.—The Electric Light Co. has informed the Municipality that it is prepared to reduce meter rents, which now stand at 4s. monthly, by 20 per cent., and the price per unit, which is now 2s. 3d., by 10 per cent. The Municipality is not, however, willing to accept these terms, and is proceeding to obtain powers and funds to expropriate. All the local bodies support the Municipality in this matter.

Lye.—Street Lighting.—The U.D.C. has decided to have installed by the Midland Electric Light Co. eight public electric lamps, which will replace those lit by gas.

Ormskirk.—Price Increase.—It has been decided to increase the charges for electrical energy for lighting, heating, power and other purposes, as from March 31st, by a further addition of 10 per cent. to the present charges.

Newquay.—Proposed Prov. Order.—The Electric Light and Power Co., Ltd., is to apply to the B. of T. for a prov. order to raise the prices as follows: for any amount up to 12 units, 10s., and for each unit over 12, 10d.

Salford.—Year's Working.—The financial results for the year ended March 31st, 1917, show a total income of £155,813. The working costs—including energy purchased—amounted to £84,334, leaving gross profit of £71,479, which equals 9·4 per cent. on capital expended. After payment of interest, £17,725, and sinking fund, £32,400, there remained a net profit of £21,354. From the net profit £12,000 has been allocated to the relief of the rates, and the remainder, £9,354, to the depreciation and renewals funds. The gross and net profits are the largest recorded in the history of the undertaking. Electrical energy sold for all purposes amounted to 29,572,331 units, against 24,856,435 units the preceding year, an increase of 20 per cent. The energy sold for lighting shows a slight decrease, but there is an increase of 13 per cent. in the supply for traction and 27 per cent. in that for power purposes. The total increase in cost of production, due to abnormal conditions, amounts to £27,500. On the other hand, increased revenue, due to advanced rates, amounts to £13,300. A sum of £24,227 was expended during the year on capital account, of which £22,844 went to machinery at Frederick Road, £519 on sub-stations, and £863 on mains and services. The capital account now stands at £620,304. There has been a saving of £17.000 in fuel alone, while the reduction in oil, stores and repairs can be taken as £2,500 per annum. This saving is almost entirely due to the increased efficiency of the modern plant recently completed, which, although supplied since the outbreak of war, was purchased at extremely favourable prices.

South Africa.—Bloemfontein.—Owing to one of the heaviest rainstorms ever known in the history of Bloemfontein, the municipal electrical power station recently became flooded, and it was necessary to shut down the plant for 48 hours. The tramcars came to a standstill and the streets were in darkness.

Paarl (Cape Province).—The ratepayers, at a public meeting convened for the purpose, unanimously resolved to adopt the proposal of the Town Council to extend the electric light installation at an additional expenditure of £2,200. The Mayor stated that the extension would yield a profit of 18 per cent.; 320 premises are now supplied with electric light, giving the municipality a revenue of £3,000 per annum.

Southport.—Year's Working.—The Electricity Committee reports a loss of £890 on the undertaking for last year, against a profit of £2,682 for the previous year. The loss is attributed mainly to the extra cost of coal and war bonuses to workmen.

South Shields.—Year's Working.—The revenue for the year ending March 31st, 1917, amounted to £32,370, an increase of £1,632, or 5·3 per cent. compared with the previous year. The bulk of this increase is accounted for by power consumers, from whom the gross revenue obtained amounted to £11,168, an increase of £1,828, or 19·5 per cent. The revenue derived from electricity used for heating purposes is £767, an increase of £228, equivalent to 12·5 per cent. over the corresponding figure for the previous year. Revenue obtained from energy sold for lighting purposes is practically stationary, being £2.224 less than in normal times. Working expenses amounted to £18,829, a net increase of £1,606, or 9·4 per cent., and there is an increase of £801 for income-tax. In spite of these increases the works costs have been reduced from 0·57d. to 0·56d. per unit, and the total costs from 0·912d. to 0·909d. per unit. During the whole war period the fuel costs have been less than previously, this being due to the new boiler plant, which enabled a very low grade of fuel to be [illegible] The gross profits amount to £13,541, an increase of £36, or 0·2 per cent. Capital expenditure stands at £227,717, the total expended during the year being £2,619. There has been no increase in tariffs over pre-war rates, but there has been a deficit on the year's working for the past two years. This has been met out of the reserve fund, which now stands at £12,189, equivalent to 5·3 per cent. of the capital expenditure, without unduly decreasing the reserve, or increasing the tariffs.

Stamford.—The T.C. has granted permission to the Electric Light Co. to erect an overhead cable along the side of Ryhall Road, to Messrs. Martin's works.

Whitehaven.—Loan Application.—The Lighting Committee of the T.C. has decided, in view of the increased demand for power, to apply for sanction to a loan of £2,000 for the installation of a 200-kw. generating set.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—Under the new award affecting tramway workers, Accrington Corporation will be involved in an additional expenditure of between £1,800 and £2,000 a year. Compared with pre-war rates, the wages at present paid have increased by £6,000 per annum.

Birmingham.—Bonus Question.—A week ago the Committee on Production decided to grant the 12½ per cent. bonus to the workmen employed in the gas and water departments and the men engaged at the tramway depôts, as from February 13th. The men objected to this, as the 12½ per cent. award to the munition workers (including Corporation electrical employés) was dated October last, and at a mass meeting decided to come out on strike at the end of the week if the payment were not made retrospective to last autumn. On Friday conferences took place with the Salaries and Wages Committee of the Corporation, and the result was, after a withdrawal of the strike notice by a large deputation of the operatives, to leave the matter for settlement to the Lord Mayor (Ald. A. D. Brooks). He decided in favour of altering the date for the payment of the bonus to December 15th, and this decision was received with cheers. The motormen and conductresses on the tramways were not included in the award of the Committee on Production, and it was agreed to make at once a joint application to that Committee to make an award without delay.

Bradford.—Tramways Strike.—The Corporation tramcars were brought to a standstill last Saturday morning, the employés deciding on a strike at the end of the Friday night service. The trouble has been brought about by the women employés, who contend that they are entitled to the full extension to £1 per week bonus above pre-war wages recently awarded to men transport workers. The women who have replaced men are paid the same wages as the men. The contention of the Tramways Committee is that as the bonus paid to women is different to that of the men, they should receive only the same advance as that just granted by the national award to the men, which in the case of the Bradford workers is 4s., the difference between 16s. and the new figure of £1. The women's bonus was 9s., so that, granted an advance of 4s. like that which brings the men up to £1 above pre-war rates, the women get 13s. above those rates. Both parties have now agreed on an appeal to the Committee on Production, but a settlement is hindered by a demand issued on Sunday that the Committee on Production should give its promise within three days to deal with the matter.

Continental.—Switzerland.—The electrification of the Scherzlingen-Berne and Brigue-Sion lines has just been approved by the Administrative Council of the Swiss Federal Railways. This electrification is to be carried out as speedily as possible; it will require 17 electric locomotives and involve an outlay of 9.700,000 fr. Another scheme, having in view the electrification of the whole of the Swiss railways by means of hydro-electric energy, is also under consideration. The estimated outlay is put at 500,000,000 fr. The Swiss Federal Railways Administration is specially bent on the realisation of this scheme, in order to free the Republic from dependence on Germany for imports of coal, with its contingent political embarrassments.

Italy.—The details of the electric railways from Pracchia to San Marcello Pistoiser are definitely settled as follows:—The line will be of the normal gauge, and it will put into communication with Porrethana the numerous centres which have their head at San Marcello, and facilitate the service of important industrial establishments such as those of Cartierelini, the Metallurgica Italiana, the Gamberini foundries, &c. The length of the line will be about 15 kilometres; starting from Pracchia it will cross the river by an armoured concrete bridge 56 metres long, and in about the middle of the course will pass under Mount Oppio by a tunnel 556 metres long, thence continuing to Limestre and its terminus at San Marcello. The equipment will comprise 12-metre Vignoles rails, of a weight of 12,500 kg., the system of traction being continuous current at about 800 volts. The electric power will be drawn from the works of the Società Ligure-Toscana. The cost of the undertaking is estimated at 3,000,000 lire, with rolling stock costing 500,000 lire.

Dublin. -Wages and Discontinued Services.—The United (Electric) Tramways Co. has issued a statement to the effect that inquiries made from the Committee on Production and at the Ministry of Labour show that it is not bound by the terms of the award of 20s. a week on pre-war rates to the employés of English companies. The company holds that it would be manifestly inequitable if the same war advances applied in existing circumstances to Great Britain and Ireland, pointing out that the conditions differ in British centres. The directors have again considered the war wages question, and have decided to give a further advance of 4s. per week to motormen and conductors, making an increase of 12s. 6d. and 13s. on pre-war rates. The men have been advised by their Union officers to accept the 4s. advance, but it is understood that if the Government do not fix an arbitration date, a fresh notice to stop work in seven days will be handed in on a claim for the full £1 advance on pre-war rates.

On Monday notice was given that in consequence of the urgency of conserving coal supplies, the company is compelled to reduce the services as from Thursday, 21st inst.

The Transport Director announces that owing to the tonnage difficulty a diminution of 1,000,000 tons a year in the Irish coal supply, or about one-fourth of the usual supply, is expected, and a Committee of the principal importers and users is to take in hand the proper apportionment of supplies.

Higher Fares on Tramways.—In connection with the recent award by the Committee on Production to tramway workers, the following resolution was adopted at a preliminary conference of tramway employers and Unions called by the Chief Industrial Commissioner :—"That Sir George Askwith be asked to obtain from the War Cabinet an undertaking that they will take immediate steps to authorise the increase of the maximum tolls and charges, whether statutory or otherwise, which may be demanded on all tramways or light railways, by an amount to be decided by the Board of Trade." This resolution was signed by Mr. J. B. Hamilton, representing the Municipal Tramways Association ; Mr. R. J. Howley, representing the Tramways and Light Railways Association ; and Mr. R. Williams, secretary of the National Transport Workers' Federation, representing the men's Unions. The resolution indicates that all parties to the arrangement are agreed that the advances necessitate an increase in fares on tramway systems.

Leeds.—Wages.—The terms of the award of the Committee on Production are to be applied immediately to the drivers and conductors on the Leeds tramways. Drivers who received 37s. 6d. pre-war wage and 15s. war bonus will now have their bonus increased to £1 ; women conductors who received 27s. 6d. + 12s. war bonus will have their bonus increased by 4s. The question whether the award is to apply to women who do not yet participate in the war bonus is to be referred to the Committee on Production.

Railway Workers' Wages. — The Executive of the National Union of Railwaymen has decided to apply to the Railway Executive for a further advance in wages to the employés of British railways. This application is an outcome of the 12½ per cent. increase conceded to the general body of workers coming under the munitions trades, and railway workers now claim to be placed on terms of equality with other workers.—*Daily Telegraph.*

TELEGRAPH AND TELEPHONE NOTES.

Leeds.—Mr. T. B. Johnson, the superintendent engineer of the telephone department at Leeds, states that unless an unexpected hitch occurs to check progress, the change to the automatic system will be made in Leeds in May.

Spain.—On the promulgation of a decree dissolving societies of employés of Government Departments, last week, the whole of the employés of the Posts and Telegraphs refused to submit to it, and the telegraph service throughout the country came to a standstill, except in isolated cases. On Saturday the telegraph service was placed under military control, and the telegraph offices were occupied by troops. Decrees were also published in the *Official Gazette* dismissing the employés of the postal and telegraphic services, who will be mobilised under military law.

On Monday the Government settled the dispute by granting all the demands of the employés.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Aberdeen.—April 9th. Electricity Department. One 5,000-kw. turbo-alternator, surface condenser, and auxiliaries. See "Official Notices" to-day.

Australia. —Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Darlington. — March 29th. Electricity Committee. Water-tube boiler, economiser, cooling tower, fan, and feed pump. See "Official Notices" March 15th.

Eastbourne.—March 25th. Electricity Department. Six or twelve months' supply of pea or slack coal. See "Official Notices" March 15th.

Edinburgh. — March 30th. Electric fittings, &c., for Midlothian and Peebles District Asylum, Rosslynlee. Clerk and Treasurer, 19, Heriot Row, Edinburgh.

Halifax.—March 26th. B. of G. Electrical fittings for six months. Mr. A. T. Longbotham, Clerk to the Guardians, Carlton Street, Halifax.

Manchester. — March 27th. Electricity Committee. Supply and laying of 33,000-volt E.H.T. cable. See "Official Notices" March 8th.

April 2nd. Corporation Electricity Committee. For Moss Side sub-station. Three 3,000-K.V.A., 33,000-volt, three-phase, static transformers. Specifications, &c., from Mr. F.E. Hughes, Electricity Department, Town Hall.

March 25th. L. & Y. Railway Co. Various stores for 12 months, including : (36) Signal, telegraph and electrical fittings. (37) Signal, telegraph, and electric light wires. (44) Siemens and electrical steel sheets. Mr. Waring, Stores Department, Osborne Street, Manchester.

CLOSED.

Government Contracts.—List of new contracts placed in February, 1918.

War Office.

X-Ray accumulators.- Premier Accumulator Co., Ltd.
Dynamos.—Brush Electrical Engineering Co., Ltd. ; Electric Construction Co., Ltd. ; General Electric Co., Ltd. ; Rhodes Motors, Ltd. ; Newtons, Ltd.
Generating sets.—Browett, Lindley & Co., Ltd. ; Electric Construction Co., Ltd. ; Petters, Ltd. ; Siemens Bros. & Co.
Motors, &c.—Electric Construction Co., Ltd.
Electric light set.—Coventry Simplex Engines, Ltd.
Electric switchboards.—General Electric Co., Ltd.
Steel tubes.—Stewarts & Lloyds, Ltd.
Iron wire.—R. Johnson & Nephew, Ltd. ; Rylands Bros., Ltd. ; Shropshire Iron Co., Ltd.

India Office. Store Department.

Brass tubing.—Earle, Bourne & Co.
Copper wire.—J. Wilkes, Son & Mapplebeck.
Tubes.—Stewarts & Lloyds, Ltd. ; British Mannesman Tube Co.

H.M. Office of Works.

Engineering services.—H.M. Fuel Research Station, East Greenwich Electric push-button goods lift.—Aldous & Campbell, Ltd.

Post Office.

Repairing wire apparatus.—Wynn, Timmins & Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd. ; British L. M. Ericsson Manufacturing Co., Ltd. ; Western Electric Co., Ltd.
Battery boxes.—W. D. Tucker & Sons, Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd. ; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—B.I. & Helsby Cables, Ltd. ; General Electric Co., Ltd ; W. T. Glover & Co., Ltd. ; Henley's Telegraph Works Co., Ltd. ; India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd. ; Johnson and Phillips, Ltd. ; Union Cable Co., Ltd. ; Western Electric Co., Ltd.
Telephone cable.—Peel-Conner Telephone Works, Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—B.I. & Helsby Cables, Ltd. ; London Electric Wire Co. and Smiths, Ltd. ; Western Electric Co., Ltd.
Terminal irons.—Walls, Ltd.
Telephone lamps.—General Electric Co., Ltd.
Distribution cable plugs.—B.I. & Helsby Cables, Ltd. ; Henley's Telegraph Works Co., Ltd.
Stay rods.—Bullers, Ltd. ; Bayliss, Jones & Bayliss, Ltd.
Insulators, spindles.—Bayliss, Jones & Bayliss, Ltd. ; Bullers, Ltd. ; Guest, Keen & Nettlefolds, Ltd. ; T. W. Leach, Ltd.
Wire strainers.—S. Venables & Son.
Stay swivels.—Bullers, Ltd.
Telephones.—Gent & Co., Ltd. ; Peel-Conner Telephone Works, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd. ; B.I. & Helsby Cables, Ltd. ; Shropshire Iron Co., Ltd. ; F. Smith & Co. incorporated in the London Electric Wire Co. & Smiths, Ltd.
Galvanised steel wire.—R. Johnson & Nephew, Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 22nd. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Pyrometers and Impact Testing," by Mr. C. E. Foster.

(Midland Section).—Friday, March 22nd. At the Imperial Hotel, Temple Street, Birmingham. At 7.45 p.m. Paper on "Constructional Engineering," by Mr. G. W. Costigan.

Royal Institution of Great Britain.—Friday, March 22nd. At Albemarle Street, W. At 5.30 p.m. Lecture on "Radiation from System of Electrons," by Prof. Sir J. J. Thomson, President R.S.

Saturday, March 23rd. At 3 p.m. Lecture on "Problems in Atomic Structure," by Prof. Sir J. J. Thomson, President R.S.

Physical Society of London.—Friday, March 22nd. At 5 p.m. At the Imperial College of Science, South Kensington. Fourth Guthrie Lecture on "The Origin of Spectra," by Prof. J. C. McLennan.

Institution of Electrical Engineers.—**(Manchester Local Section).**—Tuesday, March 26th. At the Engineers' Club. At 7 p.m. Paper on "The Mechanical Design and Specification of the Turbo-alternator Rotor," by Dr. S. F. Barclay.

Greenock Electrical Society.—Thursday, March 28th. At 7.45 p.m. At 22, West Stewart Street. General meeting. Saturday, March 30th. Visit to McAlpine's Lead Works, Govan.

NOTES.

The Electrical Wages Award.—According to the *Daily Telegraph*, the Minister of Labour averted a stoppage of the London electrical services on Saturday by arranging to secure the payment to electricians of the extra wages granted to them last January, if necessary by Government re-imbursement of the contractors whose contracts did not allow for the extra payments. "The men concerned were City munition workers, who alleged that some of the Government contractors had not made the grant. It was feared that the Tubes, trains, factories, and all services depending upon electrical supply would be interfered with. Happily the intervention obviated this possibility."

Appointments Vacant.—Meter tester (£3), for the Borough of Salford Electricity Department; switchboard attendant (£117 + 12½ per cent.), for the Borough of Nuneaton Electricity Department; senior charge engineer, for the North Metropolitan Electric Power Supply Co., St. Albans; charge engineer, also engine-driver (40s. to 45s.), for the Dover Corporation Electricity Works; switchman (65s. 6d. + 12½ per cent.), for the City of Birmingham Electricity Supply Department; mains foreman (60s. + 12½ per cent.), for the Londonderry Corporation Electricity Department. See our advertisement pages to-day.

Chief Technical Assistants' Association.—The Hon. Secretary of the Chief Technical Assistants' Association informs us that the Executive Committee is giving the question of the membership of the senior technical officers of the undertakings outside Greater London every attention, and it is hoped very shortly to submit proposals to those interested. In the meantime, the senior technical officers of the grades eligible for membership, who have not yet communicated with the hon. secretary, should do so; apart from the advantages of all senior technical officers in the United Kingdom being associated, and, consequently, having a medium for the interchange of information and other matters, the formation of the new Association or Institution can be materially assisted by the existing Associations, and on this ground alone, if not on any other, all senior technical officers should put themselves forward for election to membership, with a view to obtaining the requisite representation in connection with their professional status and appointments, before, or on, the Committee or Committees which may undertake the drafting of the articles of the new Association or Institution.

Foreign Trade.—The February Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	February, 1918.	*Inc. or dec.*	*2 months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	55,876	− 51,464	− 96,569
Machinery	1,106,837	+596,612	+ 565,954
Exports.			
Electrical goods ...	156,545	−114,395	− 349,795
Machinery	1,325,331	−482,993	− 1,208,019

Water Power in Co. Donegal.—In the *Irish Builder and Engineer* for March 16th, Mr. Thos. M. Batchen, M.Inst.C.E discusses Ireland's possibilities of power development. Unfortunately, the flow of the great rivers is so variable, that without impounding on a large scale it is impossible to get a very high range of continuous power; nearly all these rivers originate in, and flow through, agricultural or pasture lands, and any water-power scheme involving the flooding of cultivated lands will not be looked upon with sympathy.

The author therefore directs attention to those parts of Ireland where the disabilities attending the great rivers do not obtain, and where smaller installations may be constructed at comparatively little cost per H.P. The Donegal Highlands, Connemara, and Kerry are not unlike the Scottish Highlands in topography, and are subject to an annual rainfall in excess of the figure assumed in Mr. Newlands's paper (abstracted in the Elec. Rev. of February 8th, 1918).

The numerous loughs and well-defined valleys of Donegal lend themselves readily to the cheap impounding, and subsequent regulation of discharge, of this considerable rainfall.

On the Clady River the level of the loughs can be raised 10 ft. in height without injury to cultivated lands or public roads, and a reservoir formed capable of containing, above the draw-off level, 350 million cb. ft. of water. The outflow through a fall of 182 ft. could produce 2,900 H.P. 10 hours a day.

On the Gweedore River, Lough Anure could be raised 25 ft. in level and rendered capable of storing over 380 million cb. ft. of water. The fall obtained is 115 ft., and the estimated power is 1,065 H.P. per 10-hour day. The powers of the Gweedore and Clady river proposals can be generated at the same place, in one power station.

At Owencarrow, Lough Veagh can be converted into a reservoir with a storage capacity of about 420 million cb. ft. Glen Lough can be raised 10 ft., and made capable of storing a further 300 million cb. ft. It is estimated that 1,950 H.P. per 10-hour day can be generated.

Electrical power could be transmitted from several generating stations to electrochemical or other works placed near one of the many Donegal harbours, so that raw material could be brought cheaply into the country, and the manufactured article as cheaply exported. Part of the power could be conveyed to Londonderry for use in the industries of that city.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending March 31st, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Officer for the Week.—Lieut. F. Gaywood.

Monday, March 25th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, March 26th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, at 7.30.

Wednesday, March 27th.—No. 1 Company, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, March 28th.—No. 2 Company, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, March 29th.—Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 10 platform, for work at Esher. Uniform. Marching Order, without rifles. Mid-day and tea rations to be carried.

Saturday, March 30th.—Headquarters closed.

Sunday, March 31st. Commandant's Parade at Waterloo Station, 8.45 a.m., opposite No. 10 platform, for work at Esher. Uniform. Marching Order, without rifles. Mid-day rations and tea ditto to be carried.

Special Orders.—All drills will take place at Headquarters, unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The British Engineers' Association.—The sixth annual general meeting of this Association was held in the Central Buildings, Westminster, on Thursday last week; Sir Wilfrid Stokes, K.B.E. (president), in the chair.

There was a large attendance of members from all over the country. The president, in moving the adoption of the report for the year, referred to the growth of the work of the Association, particularly in relation to the obtaining of inquiries from overseas, the issue of the Association's Directories, and the numerous services rendered to individual members. The new Council for the year 1918-19 was declared as follows :—

President.—Colonel O. C. Armstrong, D.S.O.

Vice-Presidents.—Mr. T. O. Callender, Sir John Cowan, Mr. Herbert Marshall, Mr. L. E. Mather, Sir Wilfrid Stokes, K.B.E. (pres. 1915-16-17), Mr. J. E. Thornycroft, Mr. Douglas Vickers (pres. 1912-13-14).

Other Members of the Council :—

Mr. Daniel Adamson	Joseph Adamson & Co., Ltd.
Mr. H. Allcock	W. T. Glover & Co., Ltd.
Sir H. Austin, K.B.E.	Austin Motor Co., Ltd.
Mr. S. Brotherhood	Peter Brotherhood, Ltd.
Sir E. G. Burls	Vulcan Foundry, Ltd.
Mr. G. Cradock..	George Cradock & Co., Ltd.
Mr. J. E. Darbishire	Hydraulic Engineering Co., Ltd.
Mr. F. C. Else ..	Wm. Cooke & Co., Ltd. (representing Crane Section).
Mr. C. H. Gilbert ..	J. Samuel White & Co., Ltd.
Mr. J. Hemming ..	F. H. Lloyd & Co., Ltd.
Mr. J. H. Humphryes.	Braithwaite & Co. (representing Steel Structural Section).
Sir J. Hunter, K.B.E. ..	Sir Wm. Arrol & Co., Ltd.
Mr. A. Jacob	British Aluminium Co., Ltd.
Mr. J. R. C. Kearns	H. W. Kearns & Co. Ltd.
Mr. C. Lister	R. A. Lister & Co., Ltd.
Mr. B. Longbottom	Electromotors, Ltd.
Mr. H. Lupton	Hathorn, Davey & Co., Ltd.
Mr. C. P. Martin ..	C. A. Parsons & Co., Ltd.
Mr. A. E. Owen .. .	Rubery, Owen & Co.
Mr. E. W. Petter	Petters, Ltd.
Mr. T. C. Stewart	Stewarts & Lloyds, Ltd.
Mr. J. C. Tennett . ..	Fullerton, Hodgart & Barclay, Ltd.
Mr. N. J. Ward	J. & E. Hall, Ltd. (representing Refrigeration Section).
Mr. J. C. Ward	Edgar Allen & Co., Ltd.
Mr. H. T. Wilkinson	Wardle Engineering Co., Ltd.

Representing other Associations on the Council :—

Mr. Stanley J. Benham ..	Assoc. Master Heating and Domestic Engineers.
Mr. George Clark	Soc. of British Gas Industries.
Mr. Arthur Gamble .	Midland Forgemasters' Assoc.
Mr. H. C. B. Underdown ..	Assoc. British Motor and Allied Manu'frs.
Mr. N. G. Gwynne	Soc. of British Aircraft Constructors.

Dr. Addison (Minister of Reconstruction) attended, and gave an address. Sir Wilfrid Stokes was heartily thanked for his services as president during the past three years.

At a meeting of the new Council, Colonel O. C. Armstrong, chairman of Messrs. Greenwood & Batley, Ltd., of Leeds, was unanimously elected president for the year.

Electrical Power Engineers' Association.—Further propaganda work is being carried out by the Northern Division of the Association, with the ultimate object of getting all power engineers, having the requisite qualifications, to become members. Several Sub-Committees have been formed, one of which is engaged on formulating a scheme for salaries of power station staffs. On Wednesday evening, March 13th, a very successful meeting was held at Blackburn in connection with the E.P.E.A., a large number of staff engineers from Blackburn, Accrington, Darwen, Preston, Rawtenstall, Nelson, and Colne being present. The chair was occupied by Mr. Moxon, of Blackburn, the convener of the meeting, who opened the proceedings with a short announcement of the reasons for calling the meeting. The chairman then introduced Messrs. A. L. Lunn and J. W. Thomas, chairman and secretary respectively of the Northern Division of the E.P.E.A. Mr. Lunn gave an excellent and interesting address on the origin and formation of the E.P.E.A., fully explaining the aims of the Association, and pointed out how important it was for all power engineers to make application for membership of the Association without delay, and, when accepted, to continue as active members. Mr. Thomas followed with a very able and concise statement, describing the lines on which the business of the Association was being conducted from the Chief Executive Committee *via* the three divisions—viz., Northern, Midland, and Southern—which in turn controlled a number of small Branch Committees.

A resolution to the effect that all present were in favour and intended to become members of the E.P.E.A. was put to the meeting, and carried unanimously.

The next general meeting of the Northern Division will be held in Manchester on April 11th.

A meeting of the Council of the London Division of the above Association was held at St. Bride's Institute, Fleet Street, on Wednesday, March 13th. Representatives from over forty London electricity supply undertakings were present. The president, Mr. A. C. Bostel (Croydon), was in the chair. The hon. secretary, Mr. W. A. Jones (Leyton), reported a gratifying continued increase in membership, and stated that the Selection Committee at its last meeting had before it over sixty applications, of which forty were accepted and several deferred for interview of applicants. In common with what exists in the Midland and Northern Divisions, engineers above the grade of engineer-in-charge are now strongly represented in the London Division, and their experience will be useful in the remodelling of the rules, on which work the three Divisions are now engaged.

The Northern Branch, of which Mr. J. W. Thomas, B.Sc., 15, Lotherton Street, Harpurhey, Manchester, is honorary secretary, is at present dealing with the members in Scotland, but it may soon be necessary to arrange for a Scottish Centre. Letters from Mr. Thomas and also the honorary secretary of the Midland Division, Mr. P. J. Burgess, 21, Geraldine Road, South Yardley, Birmingham, were received, and both reported large increases in membership since the annual Conference was held.

The application of the Chief Technical Assistants' Association for affiliation came up for consideration. The E.P.E.A. has already many chief technical assistants within its ranks, and some of the C.T.A.A. members have joined also the E.P.E.A.; the C.T.A.A. has been purely a local technical, and not a protective, Association of Assistant Engineers from municipal supply undertakings in London, and is already affiliated to the London Municipal Chief Engineers' Association—the A.M.E.E. The E.P.E.A. is a National Association with strong legal status; membership is open to all qualified staff engineers in company and municipal electricity supply undertakings throughout the country.

After discussion, it was unanimously decided that there would be no advantage in affiliation while the two Associations maintained their identities. There was a general consensus of opinion that the existence of two organisations with similar objects catering for one type of engineer was prejudicial to the interests of both, and it was only by much closer fusion than affiliation that additional influence, power, and success could be obtained.

Conference of Metropolitan Authorities.—The Conference of local authorities owning electricity undertakings in Greater London has adopted a constitution and rules, in order that the Conference may be placed on a permanent basis. A subscription of £3 3s. per annum is required, to cover the cost of minutes of proceedings, from each authority represented, and four representatives, including the engineer and town clerk, are to be appointed annually in March.

Fuel Economy.—In the House of Commons, on Wednesday last, Sir Albert Stanley said that it was proposed, as regarded Great Britain, that no light should be used for the purpose of illuminating shop windows, and that no food should be cooked or any hot meals served in any hotel, club, or restaurant between 9.30 at night and 5 o'clock the following morning. All lights in the dining rooms of these places must be extinguished between 10 o'clock at night and 5 o'clock the next morning. It was also proposed that no performance in any theatre or other public place of amusement should be conducted after 10.30 at night, or be re-opened before 1 o'clock the next day, and that all lights must be out between these hours with the exception of those actually required for the use of the employés. It is understood that at first the proposals will be applied only to the southern part of England, including London and the Home Counties.

The object of the scheme is to secure economy in the use of fuel, power, and labour, besides relieving the underground railway, tramway, and motor omnibus services. The reduction of the suburban train services at night, as well as the early and late tramway services, is, we understand, under consideration, and considerable curtailments are to be made. Strict economy, not only in the use of coal, but also in gas and electricity for lighting and other purposes, is necessary. Gas and electricity supplies will be reduced by one-sixth. As to coal, it is proposed to issue a new scale of rations which will continue for a year from April 1st next, and a 25 per cent. reduction will probably be enforced. Coal rationing will be applied to the whole country.

It is not merely that the carriage of coal to London makes serious inroads into a transport system which is becoming more congested every day, but there is pressing need of economy of man power and in the actual work at the pits. In 12 months the coal mines of the country need about 40 million cb. ft. of timber, most of which has to be cut and sawn in this country. The coal question carries others with it, not the least difficult of which is that of transport.

It is stated that Mr. Guy Calthorp, the Coal Controller, has a proposal under consideration to make the whole country south of Leeds dependent for its coal supplies upon pits in its own area, excluding South Wales.

Exaggerated figures have been given, no doubt, in connection with these proposals; here we ought to consider ourselves lucky in having as much coal as we have had all through the war. Great Britain is the only country in Europe in which a fuel crisis does not exist. According to an expert, says the *Evening News*, "London is the greatest manufacturing centre in this country, and but for the fact that electrical power has made such headway in factories we should have had a coal crisis long ago." The Board of Trade is helping manufacturers to rearrange their plant so as to enable them to take electric power from the big concerns. Through the Coal Controller steps will be taken, after consultation with the Ministry of Munitions, to curtail the public services which entail coal consumption, especially the early and late tramway services. It may become necessary for electric lighting undertakings to disconnect non-essential consumers, in order that sufficient power may be provided for industrial purposes.

The Marconi Case.—In the House of Commons, on Tuesday last, Sir Chas. Hobhouse made a statement in which he categorically denied the allegation put forward by counsel for the Marconi Co. in the action reported on another page, to the effect that he had endeavoured to induce the Telefunken Co. to come to this country and compete with the Marconi Co. He had visited Nauen, and lunched with the directors of the Telefunken Co., accompanied by Sir Henry Norman as interpreter, but did not mention the subject of competition with Marconi, then or at any time. He also declared that Mr. Godfrey Isaacs's account of the interviews with him was a pure fabrication, and that he had never acquiesced in the statement that he had given the Telefunken Co. encouragement.

Sir Henry Norman also made a statement denying that he made an offer of any kind to the Telefunken Co., or to anybody else, and pointing out that he had always maintained that the wireless chain should be erected not by any company whatever, but by the State.

On the motion for the adjournment, Sir F. E. Smith stated with regard to the contract that the view which he took was that the Post Office had, without legal warrant or justification, broken a contract, and that they were liable in damages for that breach, and he gave that clear advice. When the negotiations with the company broke down, he advised the Government that none of the legal contentions which had been raised for three years could be successfully sustained, and at an early stage of the proceedings he discovered that the Judge had formed views which agreed precisely with his own. He took the responsibility of saying that he would not allow the case to go on, the moment that the public had been informed of the circumstances.

Mr. Herbert Samuel said that he regarded the contract as a remarkably good bargain for the State. There was an understanding with reference to the second three stations that, save in very exceptional circumstances, if those stations were erected the work should be brought into the general contract with the Marconi Co.—*The Times*.

In yesterday's papers a letter from Mr. Godfrey Isaacs to Sir Chas. Hobhouse was published, in which the former challenged the latter to repeat his statement in public, in order that Mr. Isaacs might be enabled to take proceedings against him. Sir Chas. replied that he had stated the facts fully in the House of Commons, and he left it to the public to draw their own inference.

The Industrial Reconstruction Council.—This Council is holding the second of its series of provincial meetings at the Assembly Hall, Edinburgh, on Wednesday, April 3rd, at 8 p.m. The Lord Provost will preside, and Dr. Addison, Minister of Reconstruction, will be the principal speaker.

An Automatically Operated Synchronising Station.—The Iowa Railway & Light Co., of Cedar Rapids, has two 13,200-volt transmission lines which it is desirable to operate in parallel, yet which join each other at a point where it is frequently desirable to open the circuit. Moreover, it is not desirable to interrupt service on either line to bring about the paralleling of the two sections after the line has been opened. A sub-station simply for the purpose of connecting the lines together at this point did not seem to be justified. To meet this condition, therefore, the company's engineers have installed an automatic synchronising station and a set of watt-hour meters, equipped with ratchets, to record the interchange of power between the two sections of the system.

The apparatus consists of two sets of 1-kw. transformers, two sets of relays, an automatic synchronising device, a 1-kw. motor-generator set, an oil circuit breaker, and a few additional relays. The two sets of relays are connected across the phases of the secondary sides of the transformers, which are in turn connected in the 13,200-volt circuits. The contacts on these relays are in series, therefore the closing of all relays is accomplished, when all phases are energised. When all of these series contacts are closed the small motor-generator set is started. It supplies energy through its direct-current unit, when it comes up to full voltage, to close a direct-current relay. This in turn permits alternating-current energy to flow to the synchroscope. The synchroscope, manufactured by the Westinghouse Electric & Manufacturing Co., consists essentially of two solenoids acting on cores hung on the opposite ends of a rocker arm. The solenoids are connected so that the right-hand end of the rocker is at the extreme lower end of the stroke when the electromotive forces to be synchronised have no phase difference and is at the upper end of the stroke when the phases are in opposition. This causes the rocker arm to oscillate up and down. When the right-hand end of the rocker arm approaches the lower end of its motion with less than a predetermined speed a contact closes the circuit of an auxiliary relay, which in turn closes the circuit operating the closing coil of the main oil switch. The closing of the contact occurs before synchronism by a predetermined length of time sufficient to permit the main switch to complete the circuit exactly at the point of synchronism. The synchroniser does not make contact at all unless the difference in speed of the two machines at the different ends of the line is less than a predetermined amount.

This apparatus, together with the metering equipment, takes care of itself entirely, except for a visit from an attendant about once every three months. The installation was worked out for the Iowa Railway and Light Co. by John M. Drabelle, the company's electrical engineer.

Pulverised Coal.—In view of the present coal situation, the results secured in a recent 24-hour test of a 150-H.P. Brownell horizontal return tubular boiler at the demonstrating plant of the Powdered Coal Engineering & Equipment Co., Chicago, when fired with powdered coal, are of interest to every coal user.

The boiler furnace was served by two 12-in. Pruden coal carburettors. The coal burned was a high ash (22.09 per cent.), La Salle County, Illinois, screenings with a heating value of 10,158 B.TH.U. on a dry basis. The coal was dried and pulverised in the demonstration plant of the company, this coal preparation unit having a capacity of 60 tons of pulverised fuel per day. As burned under the boiler, the coal dust had a moisture content of 2.94 per cent. A screening test showed that 98.8 per cent. passed through a 100-mesh screen, and 90.5 per cent. through a 200-mesh screen.

The proximate and ultimate analysis of the coal is given in Table I :—

Table I.—*Proximate Analysis.*

	Dry, per cent.	As burned, per cent.
Moisture	—	2.94
Volatile matter	37.61	36.49
Fixed carbon	36.81	35.42
Sulphur	3.79	3.71
Ash	22.09	21.44
	100.00	100.00

Ultimate Analysis.

	Dry, per cent.
Carbon	60.86
Hydrogen	4.32
Nitrogen	0.99
Oxygen	7.95
Sulphur	3.79
Ash	22.09
	100.00

In Table II are given some of the results and data of the test :—

Table II.—*Results of Evaporative Test.*

Water heating surface : 1,504 sq. ft.
Steam pressure by gauge : 135.1 lb.
Temperature of feed water entering boiler : 145 deg. F.
Temperature of escaping gases leaving boiler : 609.8 deg. F.
Force of draught in fire box : 0.15 in.
Percentage of moisture in steam : 0.95 per cent.
Dry coal consumed per hour : 735.7 lb.
Equivalent evaporation from and at 212 deg. F. : 5,572 lb. per hour.
Equivalent evaporation from and at 212 deg. F. per lb. of dry coal : 7.59 lb.
Equivalent evaporation from and at 212 deg. F. per lb. of combustible : 9.73 lb.
Calorific value of 1 lb. of dry coal : 10,158.
Calorific value of 1 lb. of combustible : 13,039.
Efficiency of boiler, furnace, and grate : 72.8 per cent.
Efficiency of boiler and furnace : 72.5 per cent.

The CO_2 content was much higher than average or usual standard practice. The conditions under which the test was made were unfavourable from the standpoint of thermal efficiency, the average temperature of the air fed with the powdered coal being approximately 4 deg. F.

Bituminous coal, of 15 per cent. ash, under ordinary conditions of grate firing will usually be found to produce an ash which contains from 16 to 18 per cent. combustible. The ash and slag produced in the test given above contained only a trace of combustible, less than 0.1 per cent. It is evident, then, that the burning of powdered coal by the carburisation process represents a saving in this instance of 3.74 per cent. of the heating value of the coal, due to the fact that the coal is completely burned.

The results reported in this test do not represent unusual operating conditions, necessitating the supervision of trained technical men and unusual care in firing. They represent what may be obtained day in and day out, without extra precautions, and without skilled engineers.—*Electrical Review* (U.S.A.).

Tar-Oil Experiments.—In a report presented to the Dundalk Urban Council, Mr. Spalding, the Council's electrical engineer, referring to his experiments on the use of a lighter gravity tar oil, stated that although the oil possessed certain advantages on a heat energy basis, the large excess of naphthalene present in the lighter oil created considerable difficulties in regard to handling and storage. In cold weather the oil in the storage-tank and in the supply pipes became quite solid owing to the accumulation of naphthalene crystals. Trouble also arose from a similar cause with the valves of the tar-oil pumps on the various engines. It would be necessary to keep the oil stored in yard tanks at not less than 60° F. at all times, to prevent crystallisation troubles, and to effect that he was fitting over a 10-ton tank some electric heaters of a special design. When running on American crude oil, it was found necessary to clean the engine pistons only once every 12 months, but it would now appear to be advisable, with tar-oil as a fuel, to repeat this operation once every six months.

Electrical Trades Benevolent Institution : the Cardiff Concert.—The proceeds of the concert organised at Cardiff in aid of the funds of this Institution have been further increased by a donation of 25 guineas from the General Electric Co., Ltd. This brings the total amount by which the Institution has benefited by this concert to £49 5s.

Inductive Interference with Telegraph and Telephone Lines.—The Joint Committee on Inductive Interference, organised in December, 1912, by the California Railroad Commission, and authorised to conduct an investigation of the problem of inductive interference with communication circuits by parallel power circuits, has completed its work, after continuously investigating this subject for over five years, at a cost of over £20,000, borne jointly by the interested railroad, power, and communication companies and the California Railroad Commission. The investigation has obtained results of great consequence to railway, power, telephone and telegraph companies, and to manufacturers of electrical apparatus, as well as to public authorities which exercise jurisdiction over them. Some of the general conclusions have been published by the technical Press at different times during the progress of the investigation, but practically none of the technical data have thus far been made generally available. From time to time technical reports have been prepared which give the data obtained and the conclusions arrived at, and 30 of these reports have been selected for publication, together with final recommendations for rules for the prevention and mitigation of inductive interference. The book will have a complete index, and will contain approximately 1,000 pages, with over 400 drawings and 30 photographs. The publication is contingent upon obtaining, in advance, a sufficient number of subscriptions to cover the actual cost of printing and binding, at a price not to exceed $10.00 per set. Engineers interested in this problem are invited to communicate at once with the Commission, as the number of copies printed will be limited, and only those subscribing in advance can be assured of receiving copies. Inquiries should be addressed to the chief engineer of the Commission, Mr. Richard Sachse, 833, Market Street, San Francisco, Cal.

British Oil.—An offer by Lord Cowdray to spend, if required, £500,000 in boring for oil in this country has been taken up by the Government. Arrangements have been made for trial bores to be sunk by Lord Cowdray's firm in a locality where petroleum geologists expect to find oil. Mr. Bonar Law stated in the House of Commons that a satisfactory agreement had been come to with a firm which was to undertake the work.—*Daily Mail.*

Wet Condensers for High-pressure Service.— For certain investigations requiring the continuous use of a fat spark from a closed-circuit transformer of 1 kilowatt, at 11,000 volts, the glass plate condensers usually employed broke down owing to heating. After trying one-litre beakers covered with tinfoil, which proved tedious and costly to make, similar beakers (of heat-resisting glass) were partly filled with a nearly saturated solution of common salt, and partly immersed in a similar solution contained in earthenware vessels. The surface of the liquid was covered with a layer of oil 5 cm. deep to eliminate sparking. The mean capacity of each jar containing four beakers was 0·0092 mfd., and the condensers gave perfect satisfaction under severe use for many months. The cost was about the same as that of glass plate condensers. Sets made up with mercury instead of salt solution had a capacity about 10 per cent. higher, when measured at a low constant pressure, but at the high and discontinuous pressures employed to produce the spark, the capacity of the mercury-filled condensers was judged by the fatness of the spark to be three or four times as great as that of the condensers with salt solution.—E. Karrer and H. S. Newcomer, in *Science.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. L. W. Woodman, who resigned his position in Dover as borough electrical engineer, in order to take up an appointment on 20th inst. as electrical engineer to the National Smelting Co., Avonmouth, desires manufacturers to forward copies of their catalogues and price lists. The duties of Mr. Woodman's appointment will probably not be confined to the Avonmouth works, but will, in the near future, include the supervision of the electrification of other industrial undertakings.

Swansea Corporation Electricity Committee has increased the salary of Mr. Rees, the deputy borough electrical engineer, to £300, without bonus.

Fulham E.C. recommends that a gratuity of £50 be paid to Mr. A. Murdoch, station superintendent at the borough electricity works, for extra services rendered by him in his own time, during the past 12 months, in connection with the extension of the boiler plant.

Blackburn Electricity Committee has decided to grant Mr. Wheelwright (electrical engineer) an honorarium of £500 for the special work executed in his department since the war began.

Mr. W. Fennell, resident engineer at St. Albans for the North

Metropolitan Electrical Power Supply Co., and previously borough electrical engineer at Wednesbury, has been appointed engineer and secretary of the Northwich Electric Supply Co., Ltd., in succession to the late Mr. W. Boyd.

The Dundalk U.D.C. has increased the salary of Mr. P. A. Spalding, electrical engineer and manager, from £300 to £400 per annum.

Accrington General Purposes Committee recommends an increase of £50 a year to the borough tramways manager, Mr. H. Pilling. It also recommends war bonuses ranging from £35 to £15 a year to officials and staffs, in addition to a previous bonus of £15 a year.

General.—Mr. M. W. Clarke, who has held the post of technical assistant and head of the testing department in the electrical department of Messrs. Cammell, Laird & Co., Ltd., Sheffield, for the past five years, is shortly leaving to take up an appointment as chief electrical engineer to Messrs. Spencer & Co., Ltd., electric conveyor and elevator builders, Melksham, Wilts.

On Friday last the heads of the wholesale and retail electrical firms in Bristol entertained Mr. Arthur H. Dowson, of Veritys, Ltd., at Stuckey's Restaurant, Wine Street, at a farewell dinner, and presented him with a 52-oz. silver tray, suitably inscribed. Mr. A. C. Wiley (the chairman) and Mr. E. Fifield (vice-chairman) referred to the esteem in which Mr. Dowson was held in the district, and expressed the good wishes of the company on his taking up his new position with the Imperial Tobacco Co., Ltd.

By deed poll, Mr. William Beisiegel, electrical engineer, of 80, Montholme Road, Clapham Common, has changed his name to William Simmonds.

Captain H. W. Grant, C.B., R.N., has been appointed joint managing director of the Eastern Telegraph Co., Ltd.

At St. Mary's Church, Dunsford, on March 9th, the marriage took place of Captain Reginald F. Long, M.C., Royal Artillery Special Reserve, A.M.I.E.E., and Miss Ethel Gertrude Downer, of Godalming.

Roll of Honour.—Sergeant Wm. Brayshaw, K.O. Rifles, reported seriously wounded, was employed with Mr. Horace Green, electrical engineer, Cononley, Yorkshire.

Private F. B. Lane, West Riding Regiment, killed in action, was with Messrs. Bullers, Ltd., of Hanley.

Lieut. J. R. Beckton, R.E., killed in action, was, prior to the war, a draughtsman with Messrs. Crompton & Co., Chelmsford.

Captain E. Mannock, R.E., attached to the R.F.C., formerly of the staff of the National Telephone Co. at Wellingborough, has gained a bar to his Military Cross for destroying several German aircraft in aerial fights.

Obituary.—Mr. George Herbert Carter, late electrical engineer to the Heckmondwike District Council, died on March 13th, at the age of 57. He had been in failing health for some time.

Will.—The late Mr. G. Beith, electrical engineer, of Pontypridd, left £24,865 gross and £24,352 net personalty.

NEW COMPANIES REGISTERED.

Boving Engineering Works, Ltd. (149,748).—Private company. Registered March 1st. Capital, £70,000 in £1 shares (30,000 pref. and 40,000 ord.). To take over the business of constructional engineers, ironfounders, and boilermakers carried on by Hartley, Causton & Richmond, Ltd., and to enter into agreements with (1) Boving & Co., Ltd., and (2) Electro Metals, Ltd., and Boving & Co., Ltd. The subscribers (each with one preference share) are:—S. J. Collins, 39, Chester Road, Lower Edmonton, N., accountant; J. A. Hartigan, 79, Wernbrook Street, S.E. 18, departmental engineer. The first directors are: J. O. Boving, S. D. Lane, C. T. Colpitts, A. Eving, and F. Keer. Qualification, £100. Remuneration, £100 each per annum, and a percentage of the profits after 7 per cent. is paid on the ordinary shares. Registered office: Imperial Buildings, 56, Kingsway, W.C. 2.

Electric Deposits, Ltd. (10,017).—Private company. Registered March 7th. Capital, £5,000 in £1 shares. To carry on the business as indicated by the title, and that of engineers, machine and tool makers, &c. The subscribers (each with one share) are:—John T. Ballantine, 39, Bath Street, Glasgow; Hugh McKellar, 36, Bath Street, Glasgow. The first directors are:—A. Ness, D. O. Mitchell, and J. F. Ballantine. Registered office: 250, Great Western Road, Glasgow.

Fricker's Metal Co., Ltd. (149,885).—Registered March 15th. Capital, £80,000 in £1 shares (21,500 pref.). To take over the business of manufacturers of zinc oxide carried on by a company of the same name (incorporated in 1910) at Langley Metal Works, Luton; also to carry on the business of electrical and mechanical engineers, &c. The subscribers (each with 50 ord. shares) are:—E. H. Wood, Campana, Sidcup, chairman of a company; G. C. Fricker, The Limes, Harpenden, engineer; F. Miller, 4, Redington Road, N.W. 3, chemical engineer; D. Perry, 1, Albert Drive, Glasgow, manufacturing chemist; C. W. King, High Street, March, Cambs., solicitor; H. E. Carey, 53, Cardiff Road, Luton, company secretary; S. Young, Cecil House, Holborn Viaduct, E.C., company director. Minimum cash subscription, 10 per cent. of any shares offered to the public. The first directors are:—G. C. Fricker, F. Miller, and J. A. Wood. Registered office:—Langley Metal Works, Langley Street, Luton, Beds.

Motive Power Improvement Co., Ltd. (149,791).—Private company. Registered March 6th. Capital, £6,850 in £1 shares (3,500 pref.). Mechanical and electrical engineers, and manufacturers of machinery of all kinds, marine engineers, gas makers, shipowners, shipbuilders, &c. The subscribers (each with one ord share) are:—F. H. Wyvill, 1, Fairfield Road, Crouch End, N., law clerk; R. Spence, 77, Drakefield Road, Tooting, S.C., accountant's clerk. The first directors are to be appointed by the subscribers. Registered office:—Norwich House, Holborn, W.C.

Calgray & Co., Ltd. (149,849).—Private company. Registered March 13th. Capital, £6,000 in £1 shares. To take over the business of manufacturers of electric wires, &c., carried on at 326, Goswell Road, E.C., as Calgray & Co. The subscribers (each with one share) are:—E. Calvert, Quennington, Duke's Avenue, Finchley, N., engineer; T. J. Grainger, 8, Ashgrove Terrace, Gateshead-on-Tyne, merchant. The first directors are:—E. Calvert and T. J. Grainger. Qualification, £250. Registered office:—326, Goswell Road, E.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London United Tramways, Ltd.—Particulars of £33,000 second and £68,000 third debentures created April 3rd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount of each series issued on February 27th, 1918. Property charged: (a) The company's undertaking and property, except Hammersmith tramways, Chiswick property, and lands acquired for road improvements, and (b) uncalled and unpaid capital.

Cutting Bros., Ltd.—Particulars of £15,000 debentures created February 14th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Particulars of £17,500 debentures created December 20th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Imperial United Lamp Co., Ltd.—Particulars of £7,000 debentures created January 18th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £6,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Aldeburgh Electric Supply Co., Ltd.—Debenture dated February 9th, 1918, to secure all moneys due or to become due (not exceeding £2,500) to Barclays Bank, Ltd., charged on the company's undertaking, real and personal estate, patent assets, and effects, including any issued or uncalled capital (but not unissued capital and calls already in arrears).

British Electrolytic Zinc Co. (Isherwood Process), Ltd.—Charge dated February 21, 1918, to secure £2,000 and further advances, not exceeding £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. E. Heath, 3-4, Royal Exchange Buildings, E.C. 4.

Allen, West & Co., Ltd.—Particulars of £55,000 debentures created December 3rd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital.

Capital, £30,000 in £1 shares. Return dated December 17th, 1917. 28,472 shares issued and fully paid. Mortgages and charges: £20,000.

British Battery Co., Ltd. (137,905).—Capital, £1,000 in £1 shares (800 pref.). Return dated January 3rd, 1918. 800 pref. and 199 ord. shares taken up; £999 paid. Mortgages and charges: £1,300.

Alliance Electrical Stores, Ltd. (111,804).—Capital, £25,000 in 47,500 pref. ord. shares of 10s. each, and 1,250 def. ord. shares of £1 each. Return dated February 22nd, 1918. All shares issued. £3 10s. paid on seven pref. ord.; £24,996 10s. considered as paid on the remainder. Mortgages and charges: Nil.

David Bridge & Co., Ltd. (106,016).—Capital, £25,000 in £1 shares (16,000 pref. and 9,000 ord.). 15,830 pref. and 4,170 ord. shares taken up to February 26th, 1918; £20,000 considered as paid. Mortgages and charges: £8,800; also secured by debenture trust deed, charge on certain land, by way of guarantee of perpetual yearly rent, charge of £54 until buildings are erected on other lands.

CITY NOTES.

Charing Cross, West End and City Electricity Supply Co., Ltd.

The report, to which we briefly referred last week, gives the following results for 1917:—

West End Undertaking.—Gross earnings £165,136, against £150,473 in 1916; expenses, excluding depreciation, £103,268, against £78,831 in 1916; net earnings £61,869, against £71,641. Including £15,089 brought forward, and other items £5,156, less £17,829 for debenture interest and £22,000 put to depreciation, there is a net revenue balance of £42,285. The preference dividend, and 4 per cent. on the ordinary shares are paid, leaving £8,285 to carry forward. The connections are 740,989 (30 watts), consisting of 462,376 lighting, 52,912 heating, and 225,701 motive power. Units generated 3,042,303, bought 14,939,928. Units sold 12,389,551. 303 public lamps used 379,025.

City Undertaking.—Gross earnings £212,542, against £176,161 for 1916; expenses £147,153, against £110,909; net earnings £65,388, against £65,555. Including £18,000 brought forward, and deducting £29,131 for debenture, loan, and other interest, the balance is £54,257. The preference dividend absorbs £18,000, leaving £36,257, of which £18,257 is put to general reserve (income) account, and £18,000 is to be carried forward. The connections are 789,597 (30 watts), consisting of 324,122 lighting, 87,656 heating, and 377,819 motive power. Units generated 39,478,730, sold 32,209,425; used on works and in transmission and distribution 7,269,305.

Davis and Timmins, Ltd.

Sir Henry Mance, presiding at the annual meeting, after going through the accounts, said that the net profit was a little less than for 1916, owing to higher prices of metal and heavy cost of labour. With regard to the future, he must again warn them that the results of the last year or two must be considered entirely exceptional. It would be impossible for them to continue for an indefinite period, but he had every confidence that when normal times and normal business returned the dividends would be quite as good as immediately before the war.

Mr. G. E. Davis, the managing director, addressed the meeting, giving information as to the state of the works, as to the conditions under which the results were obtained, and a forecast of the future as it appeared to him. In their case he did not think they need anticipate immediate and sudden changes on the cessation of hostilities. Their war work did not differ materially from their peace-time work. Though their manufactures were certainly varied in pattern, shape, size, &c., and numbered in thousands at all times, their general nature was always much about the same. When Peace came they ought to be in as good a position as before the war. They might have to meet more competition, but that would only spur them on to further efforts. Much would have to be done all over again to renew contracts and relations with their suppliers of raw material. None of their supplies ever came from Germany, nor ever would so long as he had a voice in the matter.

South London Electric Supply Corpn., Ltd.

In the course of his speech at the annual meeting, the Chairman said that the total receipts had increased by £7,619, or nearly 13 per cent., but the expenditure had risen by £5,068, or 16.5 per cent. Coal increased by £4,297. The price of coal delivered on to their sidings was about double that ruling before the war, and the quality was very inferior, the ash contents being exceedingly high, and involving increased costs for labour in handling. The capital expended during the year was £13,552, chiefly for new mains and conduits, it having been necessary, owing to the very heavily loaded condition of the feeders and distributors in the northern area to augment the supply there. The opportunity was accordingly taken, when the County of London Co. were laying their conduits for the bulk-supply cables, to provide additional conduits for their own purposes, and to draw in a new feeder cable of 2,000-kw. capacity for the purpose of relieving the existing mains and providing additional capacity to meet the demand as it occurred. This feeder cable would terminate in a new sub-station, in the vicinity of the principal power load, from which all demands for supply for some time to come could be adequately satisfied. Owing to great difficulties encountered in obtaining materials and switchgear, and labour, the bulk supply from the County of London Electric Supply Co. had not yet been made available, but, subject to the delivery, now much overdue, of certain parts in connection with the transforming apparatus, this supply should be available very shortly. The main supply cable was completed, and ready to deliver current immediately these parts were forthcoming. Units sold showed an increase of 12.7 per cent., principally for power supply to munition factories, but the supply for heating purposes had also materially improved, due to the increasing popularity of electric heaters. It was not unlikely that proposals would come forward for the erection of super-power stations, supplying large areas in place of small stations. There was much to be said on both sides. One of the points which would have to be maintained was that London had very special circumstances and conditions of its own, and should be treated as a separate self-contained area. The recent compulsory addition of 12½ per cent. to the gross earnings of their employés imposed a further serious burden on their expenditure, and their war percentage on accounts for electricity supplied had consequently had to be increased since the commencement of the year.

Bruce Peebles & Co., Ltd.

Mr. Andrews, in addressing the annual meeting, stated that the turnover had again been increased during 1917. The value of the output was more than in any previous year, and the volume of orders for starting 1918 was greater than at any former period. With reference to their often expressed desire to add to their electrical manufacturing some other special branches of engineering work, they had now acquired the designs, patterns, and connections of a sound hydraulic and general engineering business. Considerable orders had been obtained already, and they had every expectation that the new department would not only satisfactorily enlarge their operations and add to their general stability, but would increase their business connections for electrical machinery. Even before the war they found themselves considerably hampered for want of greater facilities for building the heavier types of electrical machinery. They did their best by means of temporary expedients. The trend of the electrical engineering business was an increasing demand for larger plant, and if they were to keep their position as the largest manufacturers of electrical machinery in Scotland, and one of the leading manufacturers in Great Britain, it was essential that they should have shops suitably and adequately equipped for dealing with this heavier electrical plant, and with the hydraulic engineering work to which he had referred. Apart from this, however, it was very necessary to have additional space, so as to relieve the great congestion in their older main works, and to cope with national requirements. They had, therefore, obtained permission from the Government, and placed contracts for the building, crane, and various heavy tools, &c.; before long they hoped to have that extension in full swing. The year had been an anxious and trying period, and he was pleased to express their hearty appreciation of the work of the general manager, Mr. Bunting, and the heads of the various departments. The profit and loss account showed a profit from manufacturing and trading amounting to £23,616, as compared with £24,468 last year, and £13,945 the year before. The total gross profit was £26,247, as compared with £26,248 for 1916. When the present company was formed they had a heavy and uphill task in order to re-establish their position in the industrial world. They had a very small and totally inadequate working capital, and, to make matters more difficult, the electrical industry was at that time passing through a period of acute depression and insane competition. By steady work and persistent effort, however, they gradually and surely placed thei business on a thoroughly sound foundation, and profits were made which eventually wiped out the losses of the earlier years, but the war caught them at a most unfortunate moment, as the years on which their standard of profit had been based were some of their worst, and therefore war taxation now swept away the bulk of their profit, and only left them comparatively small residue. In practice these taxe had worked out at even a higher figure than was anticipate Their case was an exceptional one. It inflicted hardships o the shareholders, and it seemed a pity that some sligh measure of consideration could not be accorded to a company in their peculiar position, especially having regard to the fact that their normal business had necessarily been sacrificed to meet the needs and interests of the country. In regard to the reorganisation of the capital account, both the 5 per cent. mortgage debentures and the 6 per cent. unsecured debentures fell due for repayment on July 1st, 1918. The company had regularly paid the interest on the mortgage debentures, and had redeemed £25,150 of these, thus reducing the total issue of £75,000 to £49,850. With regard to the unsecured debentures, they had from time to time redeemed by purchase £15,375 out of the total issue of £66,447, thus leaving on December 31st, 1917, £51,072 outstanding. In view of the great difficulties of their position in the early days of the present company, they could claim to have done fairly well in thus reducing the total debenture debt by over £40,000, but it was obviously not feasible at the present time to pay off the remainder of these debentures and the accrued interest. The directors, after long and careful consideration and after consultation with some of the principal debenture and shareholders, formulated a scheme which was considered fair and equitable. The proposals were placed before both classes of debenture-holders and the shareholders in February, when all the resolutions were passed by large majorities. The scheme of arrangement was now before the Court for the requisite confirmation and sanction.

British L.M. Ericsson Manfg. Co., Ltd.

Mr. W. M. Crowe, presiding at the annual meeting, stated that the net profits £72,512, were the largest in the history of the company. Their position was growing stronger every year. The prospects fo the future were bright. A large canteen for the workpeople was in course of erection. The labour question had been difficult, but they had not had much of the extreme trouble experienced by some firms. The labour question was, however, still very unsettled, so that at any moment there might be an unheaval. In common with a number of other companies they had taken up a new industry, which, if liberally and fairly treated by the Government, ought to bring much business to the country, but if not so treated would cause an immense loss of capital. To them it was only a side-line of their business proper, but they had taken it up seriously, and intended going on with it. They had spent a good deal of money in developing that industry, but others had spent a great deal more, and at the special request of the Government, for the benefit of the country in its present dilemma, and for its future prosperity. They did not claim a free hand to make the public pay through the nose for these goods, but they did claim a fair price, and sufficient protection for the industry. The speaker put forward a plea for a large measure of Protection for industry when the time came. He hoped that there might be no uncertain sound on the part of the Government after the war. The Government, through the High Court, appeared to be more concerned about protecting the patents of the enemy than the more important question of allowing and encouraging progressive firms to develop new industries. He wondered what protection the German Government would give to a British patent if that patent in any way stood in the way of its industries. After our experience of German penetration and brutality, we should have no finer feelings as to their patents or other interests.

Eastern Telegraph Co., Ltd.—Owing to the continued delays in obtaining the necessary returns from foreign stations and administrations it will be impossible to present the accounts for 1917 during the month of May, when it has been usual to hold the annual general meeting. Estimates based on data received shows that the net earnings were sufficient for the usual distribution of profits. An additional payment is to be made on the ordinary stock equal to a dividend of 1½ per cent. and bonus of 2 per cent., making 8 per cent., free of income-tax, for the year.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The remarks used above in the case of the Eastern Co.

applies in this case also. A fourth dividend of 3s. per share, together with a bonus of 4s. per share, is to be paid, making a total distribution for 1917 of 8 per cent., free of income-tax.

Prospectus.—*Tees Power Co. Ltd.*—Prospectuses are a rarity in these days of war, but special circumstances have induced the Treasury to authorise new issues occasionally. It has decided to raise no objection to the issue of this company "on condition that any generating station constructed by it shall for the purposes of any scheme that may result from the recommendations of the Electric Power Supply Committee be treated as though it had been constructed under the provisions of a Special Act or Provisional Order." The company is offering until March 23rd £600,000 6 per cent. first mortgage debentures, principal, interest, and sinking fund being payable by the Newcastle-upon-Tyne Electric Supply Co., Ltd.

The debentures will be secured by a specific first mortgage upon freehold land, approximately 35 acres in extent, which has been acquired by the company, situate on the north bank of the River Tees, near Middlesbrough, having a river frontage of over 1,250 ft., with convenient access by road and railway; and upon the power station buildings, fixed plant, and machinery to be erected thereon, and the adjoining foreshore and river bed; and by a floating charge on the other assets of the company, without power to charge in priority to or *pari passu* with the debentures; and by the assignment to the trustee of the benefit of an indenture between the company and the Newcastle-upon-Tyne Electric Supply Co., Ltd., whereby the latter company, in consideration of the grant to it by the company of the right to use and occupy the power station and land, will covenant unconditionally to pay to the company periodically the amounts required to pay the interest on the debentures for the time being outstanding and the sinking fund above-mentioned and to redeem the outstanding debentures in the event of the security becoming enforceable under the terms of the Trust Deed.

Newcastle & District Electric Lighting Co., Ltd.—At the annual meeting, Dr. J. B. Simpson reminded the shareholders that the trust deed provided that the whole of the second debentures should be redeemed in 30 years by the operation of a cumulative sinking fund, a certain sum having to be applied out of the profits each year for this purpose. The amount at the credit of this fund, £13,237, was equivalent to further provision for depreciation and obsolescence, in addition to the £50,000 already mentioned. The total working costs showed an increase of £5,406, or 9½ per cent., and receipts for energy an increase of £5,463, or 5½ per cent. Units sold increased by 4 per cent. In consequence of increased costs, the directors had found it necessary to raise the price of electrical energy as from April 1st. The directors did not at present feel justified in recommending more than 2½ per cent. dividend, but they hoped in the near future to be in a position to do so. In regard to the Coal Conservation Sub-Committee's report as to an extended use of electrical energy, if the recommendations of the Committee were accepted, legislation would be necessary, but this was likely to be beneficial, not only to the public, but to the supply authorities.

Fraser & Chalmers, Ltd.—With further reference to our statement of several weeks ago respecting the purchase of the business of Fraser & Chalmers by the G.E.C., it is now announced by the directors of the former company that negotiations have been practically completed for the sale of the Erith works to the General Electric Co., including the goodwill of the manufacturing business and the construction of turbines, dry gas cleaning plant, and plant for the storage and handling of coal and ores. The company will retain the goodwill of its business in mining, milling, and metallurgical machinery, with manufacturing rights in respect thereof, and also its large merchanting business in South Africa and elsewhere, and its agencies for British and American manufacturers. The exact amount of the consideration for the sale, which is payable wholly in cash, depends upon inventories of stocks, stores, and work in progress. The purchasers will complete for the account of the company all orders now in hand for mining machinery, and Fraser & Chalmers is also negotiating for the execution of new orders for mining machinery on terms to be agreed.

Neuhausen Aluminium Co.—The net profits for 1917 of the Aluminium Industrie A.G., of Neuhausen, are reported to amount to £792,000, as compared with £682,000 in 1916, which, in turn, showed an increase of about 100 per cent. over the preceding year. A sum of £200,000 for hydraulic works and £160,000 for depreciation has been set aside previous to striking the net profits. The rate of dividend, which is maintained at 20 per cent., will be paid this time on the fully-paid share capital of £1,400,000, whereas the capital participating last year was £1,010,000. In the meantime the capital has been raised to £1,400,000 by an appropriation from the fund for the payment in full of the share capital, which was formed by allocations from the net profits. During the course of the war a total of £560,000 has been drawn from the fund for this purpose. It is now proposed to increase the capital by £280,000 by the presentation of new shares to the existing shareholders in the ratio of one new share to five old shares, thus raising to £840,000 the total amount gratuitously placed at their disposal since 1914.

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1917, £642,783; working and general expenses and renewals, £530,176. Net revenue, including balance forward, £122,242. After paying debenture interest, preference dividend, and two half-yearly dividends on the ordinary (at the rate of 5 per cent. per annum, subject to tax, and 7½ per cent. per annum, free of tax), £30,000 is put to reserve for contingencies and renewals, and £18,152 is to be carried forward. The receipts of the tramways department increased by £30,737, and those of the carriage department by £52,987. Passengers carried increased by 3,353,433 to 63,981,775. The period within which the Bristol Corporation has option to purchase the tramways has been extended to October 31st, 1918.

British Insulated & Helsby Cables, Ltd.—The profit for 1917, after providing for estimated liability for excess profits duties to date, amounts to £363,059, plus £163,647 brought forward, making £526,707. This is disposed of as follows:—Directors' and debenture trustees' fees and remuneration to works' committee, £5,915; first debenture interest, £22,500; second debenture interest, £10,000; preference dividend, £30,000; depreciation, £25,000; special depreciation, £30,000; reserve, £180,000; special reserve, £8,500; first mortgage debenture stock redemption, £5,000; 15 per cent. and 10 per cent. bonus for the year on the ordinary shares, £125,000; carrying forward £84,792. The works were exceptionally busy during the year. As already announced, it is the intention, subject to Treasury consent, to issue bonus shares by the capitalisation of £500,000 out of reserves, in the proportion of one new fully-paid ordinary share to the holder of each old ordinary share. Meeting: Liverpool, March 25th.

London United Tramways, Ltd.—According to the *Financial Times*, the committee appointed by the debenture holders has issued an interim report, in which it states that it has made considerable progress with the representatives of the shareholders in agreeing a scheme for the reorganisation of the whole capital. The arrangements are dependent upon the passing into law of a Bill now before Parliament, and until this is assured it is not possible to submit any definite proposals for the consideration of debenture holders. The proposed reorganisation provides for a great reduction of the present share capital, and the division of the existing debenture stock of £1,650,000 into equal moieties of 4 per cent. debenture stock and 5 per cent. preference shares non-cumulative for five years, but with priority of capital.

Automatic Telephone Manufacturing Co., Ltd.—Profit for 1917, after estimating excess profits duty and contingencies, £46,826, plus £14,774 brought forward. Directors' fees take £2,450, depreciation £10,000, written off underwriting commission on shares £4,000, preference dividend £12,000, ordinary share dividend 6 per cent. (less tax), £21,600, carrying forward £11,550. Work of national importance has kept the factory fully employed day and night at high pressure. No new telephone installations for public service have been undertaken during the year, but the installation at Leeds is now finished, waiting for the Post Office to put into service. It is understood that the public automatic telephone service will be available to the city at an early date. Several smaller exchanges have been undertaken during the year for Government departments, factories, and a colliery company, with satisfaction to the users.

The German Lahmeyer Co.—The directors of the Elektrizitats Gesellschaft vorm. W. Lahmeyer & Co., of Frankfort-on-Main, recommend an increase in the share capital from £1,500,000 to £2,000,000 by the issue of new shares of the nominal value of £500,000. The shares have been taken over by a syndicate at the price of 110 per cent., and will be offered to existing proprietors at 116 per cent. after the conclusion of peace. It is assumed that the additional capital is required for meeting the monetary needs of the company's subsidiary undertakings in the future. These are lighting and power works. The Zurich Bank for Electrical Undertakings, which still controls about two-thirds of the share capital in the Lahmeyer Co., is expected to take a share in the new emission.

Direct Spanish Telegraph Co., Ltd.—Including the amount brought forward, the accounts for 1917, after payment of income-tax and excess profits duty for 1916, show a balance of £45,598. After paying the 10 per cent. preference dividend, and a dividend of 5 per cent. and a bonus of 2 per cent (free of tax) on the ordinary shares, £5,000 is put to reserve, and £32,972 is carried forward, subject to special taxation. The Marseilles-Barcelona cable was interrupted during the year; the cost of repair, duly carried out, was £1,162. The other lines were in good working order throughout the year.

Hadfields, Ltd.—Further dividend on the ordinary shares of 4s. per share, together with a bonus of 1s. per share, making 6s. for the year, free of tax.

Slough & Datchet Electric Supply Co., Ltd.—During 1917 the lamps, &c., connected increased by 6,307 (30-watt) to 39,702, and the units sold by 311,624 to 1,679,183. The revenue was £14,327, against £12,012 for 1916. Increased production costs seriously reduced the profit, and no dividend can be recommended. Net profit £2,720, of which £2,000 is put to depreciation and reserve. After paying reduced fees to directors, £520 is carried forward.

Windermere & District Electricity Supply Co., Ltd.—Gross income for 1917 advanced by £55, but fuel oil increased by £4 per ton, so there was a very large advance in working expenses. Keswick Electric Light Co. has again been only able to pay 2 per cent. on account of arrears of debenture interest. Increased charges for current come into force there next month. £200 put to depreciation reserve; no dividend on preference shares; £85 carried forward.

Windsor Electrical Installation Co., Ltd.—The profit for 1917, including £519 brought forward, was £4,150. Debenture interest and preference dividend are paid, £1,500 is put to depreciation, renewal and reserve, and, after paying directors' fees and 2 per cent. (less tax) on the ordinary shares, £255 is to be carried forward.

Scarborough Electric Supply Co., Ltd.—New connections during 1917 were equivalent to 1,845 30-watt lamps, making 134,387. Units supplied 777,862. Profit £2,066. After paying bank interest and putting £1,000 to depreciation, the credit balance of £2,378 is to be carried forward.

Brompton & Kensington Electricity Supply Co., Ltd.—Final dividend at the rate of 12 per cent. per annum on the ordinary shares, making 10 per cent. for the year, less tax. Carried forward, £5,217.

British Aluminium Co., Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. per annum, making 10 per cent. for the year, less tax. To reserve £75,000. Carried forward £33,214.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during four weeks ended December 28th, 1917, 1,946,348, compared with 1,751,753 units in 1916.

Wood & Cairns, Ltd. (Electrical Factors, Edinburgh).—Dividend 10 per cent., less tax, on preference and ordinary shares. £700 to reserve, and £214 carried forward.

Madras Electric Tramways (1904), Ltd.—Final dividend on the 6 per cent. preference shares for the year to December 31st.

Robey & Co., Ltd.—Dividend, 7 per cent., less tax, on preference and ordinary shares, carrying forward £35,943.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter on the common stock.

STOCKS AND SHARES.

Tuesday Evening.

While the general course of business in the Stock Exchange continues quiet, there is a good deal of interest taken in particular markets, although the volume of business is small in consequence of the aftermath of the Tank campaign. It is thought in the Stock Exchange that another week will see the end of this factor, after which, no doubt, we shall have Budget anticipations put forward as a reason for business being slow. The various political developments abroad are sufficiently confusing to render the average investor cautious, nor is the spirit of speculation noticeably present.

Telegraph manufacturing shares are strong. The Callender's Co. has now published full particulars of the terms of the rearrangement of capital, and, thanks to this, the price of the shares has risen £1 to 18¼. Henley's, India-Rubber, British Insulated, Telegraph Constructions—in fact, any shares connected with this particular branch of industry are in eager demand, and, notwithstanding the fact that prices may not apparently respond, buyers are anxious to get the offer at any reasonable figure. India-Rubbers are 7s. 6d. up at 16. British Insulated are strong at 3¾: the company's report is a splendid one. Henley's hold their rise at 19½, on the distribution of new shares.

The General Electric Co. has taken over the Erith branch of Fraser & Chalmers, so that the reason of the rise in the price of the latter stands fully explained. General Electrics themselves are steady, the ordinary gaining ¼, and these, with the preference, still being wanted. Other shares in the group continue somewhat quiet. Electric Supply Corporation ordinary are firm at 25s., changing hands at this price a few days ago. Cromptons at 17s. for ordinary and preference alike are also steady. Edison Swan "A" shares are keeping just under 50s., and the first preference are quoted at 21s. 9d. Electric Construction Ordinary are 25s. 6d., business being done last week at 25s. 9d., and the 7 per cent. cumulative preference remains at a few pence over 20s. British Aluminiums became dullish on the dividend, making 10 per cent. for the year, whereas some had looked for 12½ per cent. Babcock drooped to 3⅜, to rally to 3½ again.

The railway markets continue heavy, and pronounced dullness is noticeable amongst the Undergrounds. Metropolitans and Districts are both a poor market. Underground Electric Incomes have again receded a small fraction to 79½, and the £10 shares are also a little easier at 32s. 6d. Interest in the shilling shares has died away, and the price sticks closely to 5s. Nor is there much business doing in the steam stocks, the only feature being the determination with which the public refuse to look at them in spite of the good yields at present obtainable.

Marconis jumped up 5/16 to 3½ on the result of the company's action against the Government. The proceedings were followed with keen attention by a much wider circle than that of the proprietors in the Marconi Co. The remarkable nature of the evidence aroused surprise on the one hand, followed by very optimistic anticipations of what the company may be expected to receive by way of compensation. The subsidiaries are unaffected, Americans being 24s. 9d., Canadians half-a-guinea, Spanish and General Wireless Trust 8s. 6d., and Marconi Marines—once more the subject of a Stock Exchange tip to buy—50s. to 51s.

Electricity Supply shares are mostly firm, but the proposals to close theatres (and possibly restaurants) at 9.30 p.m. have aroused some wonder as to how this is likely to affect lighting companies. With "Summer-time" starting sooner this year, and the prospect of London turning over a new leaf in the way of going to bed earlier, the situation holds elements of uncertainty for all concerns dealing with illumination; gas stocks have come down rather sharply of late. At last Monday's meeting of the County of London Co., the chairman announced that inter-connection between this undertaking and the South London Electric Supply Co.'s station had now been established, while they, furthermore, had become interconnected with the Sutton station of the South Metropolitan Electric Light and Tramway.

London United Tramways debenture has subsided to 42 after touching 44½. Castner-Kellners strengthened to 3⅝. Colonial and foreign issues are quiet but firm, with greater inquiry for certain of the Canadian manufacturing issues. Rubber shares have enjoyed a smart rally, on the price of the produce mounting above 2s. 6d. per lb. A large business has sprung up in the principal shares. Lively speculation in tin mines has followed the recent rise in the price of the metal. Armaments are steady, without attracting much attention.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price March 19, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6¾	+ ¼	£7 8 2
Charing Cross Ordinary ..	5	5	3⅝	— ⅛	6 18 0
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	8	3	—	6 4 4
City of London	8	8	12⅞	—	6 4 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 6 0
do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	5½	+ ⅛	6 7 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	3	4	3⅜xd	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	9	7⅛	—	6 6 4
South London	5	5	2 13/16xd	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅝	— ⅛	6 15 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	33/6	1½	12⅜	—	6 13 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15¼	—	*5 6 0
Eastern Tel. Ord.	8	8	152½	+1	*5 4 7
Globe Tel. and T. Ord.	7	7	14¼xd	—	*4 18 8
do. Pref. ..	6	6	10	— ⅛	6 0 0
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	10	15	3½	+ 5/16	4 6 9
Oriental Telephone Ord. ..	10	10	4¾	+ 1/16	2 7 1
United R. Plate Tel.	8	8	6 13/16	—	*5 17 4
West India and Pan.	6d.	6d.	1⅝	—	*3 17 0
Western Telegraph	7	8	15⅝	—	*5 2 5

Home Rails.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Central London, Ord. Assented	4	4	61½	—1	6 10 7
Metropolitan	1	1	20¾	— ¼	4 15 8
do. District	Nil	Nil	14½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	79½	— ½	*5 0 8

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66½	—	7 10 6
Brazil Tractions	4	4	44½	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	52	—1	9 12 4
do. do. Preferred	Nil	Nil	31½	—	Nil
do. do. Deferred	Nil	Nil	28	—	Nil
do. do. Deb.	4½	4½	58xd	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	33½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	88	—	—

Manufacturing Companies.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Babcock & Wilcox	15	15	3½	—	4 5 9
British Aluminium Ord. ..	7	10	1 21/32	—	6 0 9
British Insulated Ord.	17½	20	3¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	—	5 2 0
Callenders	20	20	18¼	+1	5 9 7
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3⅝	+ 1/16	5 10 4
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	—	6 0 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	19¾	+ ¼	5 1 3
Henley	25	25	19½	—	6 8 2
do. 4½ Pref.	4½	4½	3½	—	6 12 2
India-Rubber	10	10	16	+ ⅜	*6 5 0
Telegraph Con.	20	20	41¼xd.	—	*5 15 7

* Dividend paid free of income-tax.

THE CONTROL OF LARGE AMOUNTS OF POWER.

By E. B. WEDMORE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Continued from page* 246.)

The arrangement of spare plant will be found to be a quesion which vitally affects the design and use of reactances. If ve plan for five machines clearly we cannot employ six busar sections, or a symmetrical arrangement of three, and if ve use four the fifth machine cannot conveniently be conected up as a spare to any one section.

The number and size of machines should preferably be etermined so that with adequate provision for spares the achine capacity will be divided equally between the secions, the number of sections being such as to give the reuired degree of protection whilst suiting the local conditions.

We desire to transfer power from section to section for urposes of economy, and this transfer may amount to 20 o 70 per cent. of the capacity of a section. This transfer nay take place in either direction. For it to take place at ll it is necessary to set up a difference of potential between ections, whereas working conditions require that the secions shall be at substantially the same voltage.

The transfer of the energy component of current through he reactance will not require a potential difference greater han is necessary to overcome the ohmic resistance, and this ill be some small fraction of 1 per cent., perhaps one-fifth ith 10 per cent. reactance between sections. To transfer agnetising current, however, will require a relatively large otential difference, and this will be in fact the reactance rop at the current in question, and this proves to be the miting feature.

For example, with 10 per cent. reactance between sections, he difference will be 1 per cent. if the magnetising current ransferred is numerically one-tenth of the rated current apacity of a section. That is to say, to transfer this amount f magnetising current would require that the bus-bars should e run respectively ½ per cent. above and below normal.

If the load is transferred at 80 per cent. power factor the agnetising component will be 60 per cent. of the K.V.A. ansferred. If, therefore, this magnetising component is mited to one-tenth of the section capacity, the load transerred would be limited to 10/6ths of this figure, *i.e.*, one-xth of the section capacity, whereas we want to transfer erhaps four times this load.

The obvious solution appears to be to transfer the load at higher power factor and to make up the shortage of magetising current by supplying it from the machine or achines tied to the section in question.

In pushing the use of reactances up to the limit it is necesary to utilise this method of maintaining the voltage, but it not one which should be used under daily working condions. It involves underloading one or more of the machines, xtra care in running adjustments, and in case a fault occurs n the section receiving current, the voltage drop will be reater.

The practical possibilities of this method of control are at ample protection can be obtained by the use of generator nd bus-bar reactances under normal working conditions ithout resorting to transference at a power factor above at of the load; but this method can be advantageously esorted to under emergency conditions.

There is a preponderance of advantage in the use of two nit machines per section, or, of course, the equivalent in naller machines. If larger units are installed later than ere originally contemplated, these may be of twice the ze, and arranged one per section with suitable reactances, nd without materially affecting the short-circuit factor.

As a typical example of what can be done, we may take e case of five sections and two machines per section. Here ith generator reactance of 15 per cent., and bus-bar reactnce of 7½ per cent., we get a short-circuit factor of 3.3 on e maximum output. That is, a station rated to give 100,000-.V.A. output would give 333,000 K.V.A. on a fault between hases near the source.

Where relatively small and remote sources of power are oupled to a large system they improve the supply in their nmediate neighbourhood. It will generally be found that e inherent reactance in the feeders and transformers is ifficient to prevent excessive increase of short-circuit curents in the neighbourhood.

The question arises, how will the employment of reactances etween sections affect parallel running. This becomes partiularly important in the case of stations remote from one nother tied together for economy. Such ties may not be of rge cross-section, and may therefore introduce considerable esistance.

It has been found that it is not generally practicable to btain stable running conditions where the ohmic value of e total reactance in circuit between the machines is less an about twice the resistance. This necessitates the emloyment of external reactance in series with long underround tie cables of small cross-section. Where, however, there are step-up and step-down transformers in the circuit there will be ample reactance.

One must not expect to find any protection from internal resistance of faults, except when the fault is to earth through a poor earth connection, or includes a long open arc.

Where porcelain insulators are mounted in brick or stone the supporting wall reinforces the insulation, and, even if a cracked insulator discharges, the current at 6,000 volts will be quickly reduced from perhaps 5 amperes to a negligible figure as the wall dries by the heat generated.

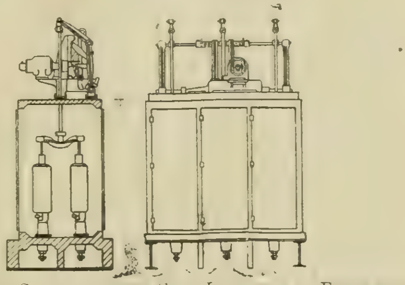

Fig. 7.—Oil Switch showing Good Insulation to Earth and Between Phases.

In the case of carbonisable material, however, as in cables and machine windings, the energy liberated at the fault will cause the conductivity to develop in a small fraction of a second to a figure offering no further limiting effect.

On a system working at, say, 6,000 volts to earth, a fault to earth of only 1 ampere releases 6 KW. to heat up the insulating material locally, and when the resistance has fallen to 5 ohms there will be a local application of more than 7,000 KW., so it is clear that the development must be extremely rapid in the later stages. On insulated systems operating at 6,000 to 10,000 volts, and even where the current to earth is limited to a capacity current of, say, 10 to 20 amperes, the first indication of a fault to earth is always the occurrence of a dead short-circuit to earth.

What happens is that the insulating material is carbonised locally so completely that the fault resistance is reduced to a point such that the energy liberated almost ceases to cause further destructive heating.

As faults to earth can be positively limited by the employment of resistance in the earth connection, it is only faults between phases that present a serious problem. The likelihood of such faults occurring can be greatly minimised by appropriate design.

When conductors are air-insulated they may be separated by substantial insulating barriers and kept clear of earthed metalwork. The barriers should be sufficiently large and substantial to confine the disturbance arising on failure of the apparatus they separate.

A good example is to be found in a large oil switch constructed as in fig. 7 with insulated tanks, those on each pole being enclosed in a stone or brick cell.

Conductors surrounded with insulating material may be further separated by earthed metal barriers so arranged that a fault to earth is confined to the phase on which it occurs.

A good example is found in a machine in which the conductors throughout their length, including the end turns, are covered with insulating material and separated by earthed metal parts with which they are in intimate contact. A breakdown on such a machine must arise as a fault to earth, and is localised by the formation of a good enclosed conducting path to earth. The risk of open arcing is minimised, and consequently the risk of the fault spreading to other phases and consuming the whole machine.

The advantages obtained by the use of selective protective apparatus on large distributing systems are now generally recognised. They play an important part in economical distribution, and an essential part not only in localising disturbances, but in limiting their duration. This latter function is useful in preventing the development of disturbance due to unstable conditions, as, for example, in parallel running, but is especially important on large plants where the factor of safety against overheating on short-circuits is likely to be small.

The use of such apparatus throws a severe duty on the switchgear, as switches have to clear faults whilst the currents are in the neighbourhood of maximum value (see fig. 1), and the onus of clearing each particular fault is thrown on the individual switch or switches nearest to it.

For these reasons it is necessary to employ with the selective protective apparatus a system of stand-by protective apparatus which comes into use in case of failure of switchgear or selective apparatus. This takes the form of a system of fixed time-limit relays with graded settings which will come into operation only after failure in the first line of defence. A plant so protected will be as well off even on failure of the selective apparatus or distribution switchgear as plants have been in the past which were protected solely by the apparatus now used as a stand-by.

It is clear, therefore, that the provision of an adequate stand-by system justifies working with a lower factor of safety on the smaller circuits, especially if the conditions are favourable and the plant well designed in the first place to minimise the occurrence of severe faults. Existing switchgear may be retained on extension of plant by relying on the stand-by protection to save the plant, if the margin is not too small.

For example, switchgear rated at 20,000 K.V.A. might be employed to clear faults of 30,000 to 40,000 K.V.A. with stand-by protection, as, if the conditions are favourable to the switch, even the larger faults may be cleared satisfactorily, and the severest disturbances should be few and far between.

The author acknowledges his indebtedness to Messrs. The British Thomson-Houston Co., Ltd., for facilitating the preparation of the paper, and to Mr. A. R. Everest and other colleagues for valuable assistance.

(To be concluded.)

ELECTRIC POWER SUPPLY AND COAL CONSERVATION.

A DEBATE on the Interim Report of the Coal Conservation Sub-Committee on Electric Power Supply of Great Britain took place at the Engineers' Club, Manchester, on March 5th. Mr. GEORGE HUGHES presided.

Mr. S. L. PEARCE, chief electrical engineer of the Manchester Corporation, was the principal speaker. He said that few reports had ever been issued which had created such widespread interest as the one under consideration. It was believed to be the work of one very eminent engineer, Mr. C. H. Merz. He viewed the report as an endeavour to formulate a national scheme for the future of electrical supplies to industry, and with the major portions of the Committee's recommendations he was more or less in agreement, in so far as they contained suggestions bearing on engineering and technical questions. As regarded the success of large undertakings, it seemed to him that the Sub-Committee's case rested to a very great extent on assertion. They were given no figure at all as to the anticipated cost of these super-power stations, the estimated cost of energy, and more particularly the cost of transmission. The case was based upon an estimated present consumption of 5 lb. of coal per H.P.-hour in industrial plants.

When dealing with the question of municipal control *versus* company control, the Sub-Committee was forgetful of the pioneer work that had been done by so many municipalities; it had attempted to belittle their work, and had developed with special pleading, and by means of unfair comparison and erroneous data, a special bias against local authorities.

The main proposals came under five heads:—(1) The setting-up of a central body of electricity commissioners; (2) the delimitation of the country into districts; (3) the appointment of boards to control the whole of the generation and transmission in these districts, leaving the detailed distribution of electricity and sale of electrical energy more or less in the hands of existing authorities; (4) the installation of large power plants in order to obtain the maximum economy in capital outlay, efficiency in operation, and diversity of demand; (5) the laying-down of a system of extra-high-tension mains which should interconnect station with station.

The first recommendation in effect was that the present system of over 600 districts, each having its own undertaking, should be superseded by a comprehensive system under which the country was divided into some 16 areas. That number was likely to be very substantially increased. For the purposes of economical production and transmission of electricity, the municipal boundary as they knew it must be broken down. Economic considerations alone should determine the electrical areas, and not local government.

The second and third recommendations both bore on the same subject, viz., the selection of sites for the new super-power stations. The Committee suggested that sites should be chosen on important waterways, and he quite agreed. The North-East Coast possessed plenty of good sites on important waterways in close proximity to collieries, but this was not the case all over the country. He knew of no inland sites in Lancashire which possessed ample water facilities for stations of, say, 100,000 KW., requiring a minimum flow of 8 to 10 million gallons per hour, or its equivalent. The alternative to these waterways was cooling towers. The strictures that had been passed by the Committee in Clause 17 on certain municipalities were based on two grounds, and the chief was that these had adopted, partially or exclusively, cooling towers for condensing purposes. A second reason was that municipalities had endeavoured to retain generating stations within city areas for the sake of the rates. So far as Manchester was concerned, they were wrong in their facts. He entirely dissented from this wholesale condemnation of cooling towers, as he held that the transmission cost from a waterside site might more than counter-balance the extra working cost due to cooling towers. The whole of this report was too much coloured by North-East Coast experience, and North-East Coast facilities. He had made very elaborate calculations, and gave them in detail in his evidence before Sir Archibald Williamson's committee. He considered the question of a Mersey-side site for Manchester at which it would be possible to obtain ample river water for condensing purposes. The load to be transmitted from the station was 100,000 KW., .8 power factor, 66 per cent. load factor, transmission voltage 150,000 volts, which was the highest voltage that had so far been used in the States. The annual charges on such a transmission line would be of the order of £100,000 to £125,000 per annum. Supposing they were to establish a station in Manchester and use cooling towers, it would result in an increased coal bill, because it was impossible with cooling towers to obtain a vacuum of more than 27 in. or 27½ in. at the outside, as against the figure of 29 in. or 29½ in. with a natural waterway and plenty of cold water. Therefore, he had assumed an increased coal consumption of 15 per cent. Then there were all the costs incidental to the towers. Summing up, he estimated that the extra annual costs for cooling towers compared with a natural waterway were of the order of £70,000 per annum. Clearly, it would not pay Manchester to go to the Mersey-side for current.

With regard to coal transport costs, taking the same data he had come to the conclusion that it would only pay to establish power stations 30 miles away from the area of supply if they could get coal 5s. per ton cheaper, facilities being the same in their own area and 30 miles away. It would not pay Manchester to have a power station at a distance exceeding 20 miles from the area of supply for the purpose of obviating the use of cooling towers, assuming there was no advantage to be gained in the cost of coal. The above figure of 20 miles could be increased to the extent shown in the previous calculation if cheaper coal and ample water were both available. Such sites did not exist in Lancashire.

The third point was that it was difficult to establish a case in favour of transmitting electrical energy rather than railing coal. The superiority of electrical transmission only became apparent with very high load factors.

His chief ground for criticism of these two recommendations of the Committee was that it appeared to lay too much stress on the suitability of a site to enable it to obtain a low cost at the station bus-bars; it had rather stressed that point because of the importance it attached to the establishment of electrochemical works alongside of the station, and had shut out to too great an extent the question of the cost of transmission. Insufficient stress was laid on the desirability of having a station site well situated with regard to the load which it had to supply. As regarded the third recommendation, he was quite at one with the Committee in insisting upon sites being chosen as large as possible in view of the possible adoption at a later date of gas distillation processes.

In the fourth recommendation the Committee advocated the preparation of plans for the construction immediately after the war of these large super-power plants. Who was the competent authority to select the sites? He hoped that the Commissioners or whatever Government tribunal might be appointed would be set up as soon as possible, so that there might be some co-ordination given to this national policy, and the final approval of the sites that might be selected should rest with the Commissioners. At present it seemed that there was a great tendency on the part of various authorities, both company and municipal, to start pegging out claims in advance. The fourth recommendation contained this sweeping statement:—"Existing generating plants are uneconomical, and ought to be scrapped." This recommendation would appear to constitute a wholesale condemnation of existing stations, some of which were fairly modern, and some of which could be usefully and economically extended. This suggestion of wholesale scrapping did not seem quite to square with the somewhat freely advertised merits of a North-East Coast supplier, and its ability to displace all and sundry private plants. Whilst it was obvious that very many plants were out of date, he dissented from the policy of wholesale scrapping.

So far as Lancashire was concerned, some existing stations could be usefully extended with large plants, and these extensions, together with the erection of the super-power stations, might very well go forward together. If such a scheme were adopted, coupled with the linking-up of the stations, that would be the line of true progress.

He fully agreed with the recommendation contained in the report that any interconnecting scheme to be effective must be coupled with unity of control. There was not much hope of a final solution to this question by voluntary effort alone. In Lancashire there was a million or a million and a quarter of coal-consuming horse-power in the 35 undertakings referred to in the Lancashire and Cheshire reports. The maximum demand on these last year was 175,000 KW., equivalent to about 600,000 H.P. installed on consumers' premises, so that the margin between the 600,000 and the 1¼ million would afford plenty of scope for power extensions.

In the fifth recommendation, viz., that by-product plant should be combined with power plant, the Sub-Committee showed a very commendable degree of caution, which was somewhat lacking in other parts of the report. The question whether electricity or electric power could be obtained more cheaply if the coal used for steam raising was first subjected to processes of carbonisation and gasification had not yet been satisfactorily answered.

The question might have to be put and answered sooner or later: Was the electric consumer to pay more for hi electric power supply in order to benefit the nation by conserving the coal supply?

With the sixth recommendation of the Committee there would be practical unanimity. Waste-heat stations had proved to be very advantageous on the North-East Coast, and in the majority of cases, he believed, they had incidentally involved the use of cooling towers.

He came to what was a very contentious point in the seventh recommendation in the Committee's report—the question of stopping extensions to all existing stations. That, he thought, was too general a statement. It was an assertion without data or proof put forward on the ground, presumably, that the new super-power station must necessarily be able to deliver energy into existing areas at a lower rate per unit than modern extensions to existing stations could possibly do. The famous Table V of this report had been very severely criticised, and should never have been found within its pages. It purported to be a comparison between the prices of energy on the North-East Coast and in Lancashire. The comparison was very misleading, and grossly unfair. Before he came to the figures, it was necessary to say a word with regard to the power companies on the North-East Coast. A pamphlet had come into his hands from the pen of a former secretary of one of the North-East Coast power companies, and a shareholder in one of the companies, Mr. Andrew Gemmell; if his remarks were not true they ought to be contradicted by the companies at the earliest possible date. He said:—

"The average selling price of ½d. per unit for company enterprise in the North of England in that report is of little value without stating the companies to which it relates, because one company or group of the existing combination can be made to have the appearance of success with disastrous results to another section of the combination; and it has been the practice of the North of England companies not to give all the statutory statistics, which would have shown annually the average selling price."

The North-East Coast output was mainly a bulk supply; lighting was a very small portion of their business. In Lancashire that was not the case. The municipalities dealt with a mixed business. The bigger proportion was power, but there was a big lighting load, and a big tramway load.

To the North-East Coast prices they must add figures that would cover the cost of transforming and distributing the high-tension energy which was delivered in bulk. Let them take the case of Tynemouth. The bulk-supply price to Tynemouth from the Newcastle Co. was not .5d.; it was .64d. These were high-tension units. After transforming and adding distribution charges, the Tynemouth prices were as follows:—

For private lighting	1.05d. per unit.
For public lighting	1.7d. per unit.
For tramway supply	1.27d. per unit.

If they would compare these prices with Lancashire, they would see they were very similar, although Tynemouth had the advantage of purchasing its bulk supply from the Newcastle Co. at what was supposed to be an extraordinarily low rate. By way of further argument, Mr. Pearce called attention to a table which he had put in evidence before the Board of Trade, dealing with an average selection of large and medium-sized towns of Lancashire and Cheshire. He dealt first of all with the average price per unit sold for industrial power purposes. It was the power delivered at the consumer's terminals at low-tension in nearly every case. The prices varied from .47d. to .68d. The percentage of industrial power units sold in these undertakings varied from 53 per cent. to 90 per cent., the Manchester figures being 75 per cent.

A very vital point was the question of finance. This comparison pre-supposed that the methods of finance of the company and municipality were exactly the same. Did the companies on the North-East Coast set aside out of profits the same amount for reserve and depreciation? They were very different indeed. Taking the case of Manchester, and comparing it with the North-East Coast, in each case the capital outlay was about 3¼ millions sterling, but whilst, for depreciation purposes, they put aside £30,000, equal to about 1.14 per cent. on the capital outlay, Manchester put aside £160,000, which was equal to 5 per cent. This deficiency alone made a difference on the Manchester output of .19d. per unit sold. It was absurd to talk of Table V. being a true comparison. He made the broad statement that, generally speaking, local authorities both produced and sold more cheaply than companies.

One of the last recommendations, viz., the advocacy of setting up electric commissions with certain definite powers, was the one point upon which there seemed to be more or less agreement. It would be an exceedingly good thing if the electricity supply industry did have a tribunal to itself. Therefore, he expressed a strong measure of agreement with the setting-up of these Commissioners with the powers that it was proposed to give them, with this proviso, that, as regarded deciding the type of district authority and the setting-up of that district authority, after the commissioners or the central authority had made up their minds as to what was the best thing to be done for this or that district, their policy or plan should receive the approval of Parliament.

With regard to the constitution of the Commissioners, the majority should be engineers with an extensive experience of the control and management of electrical undertakings. Many of the Local Government Board inspectors were not trained electrical engineers, therefore the problems they might have to consider and deal with at the inquiries were perhaps not always considered with the advantage of sound electrical engineering knowledge.

He would go a step further even than the Merz report with regard to the district boards or authorities, and would accord to them certain powers of rectifying boundaries of existing areas, for distribution purposes, and generally vest in them the final approval of the area as laid down for local distribution purposes.

Coming to the last section of the Merz report, dealing with alternative types of new electric power organisations, or district authorities, he saw no solution along the line of combined ownership and operation by local authorities and companies. Any such scheme would sooner or later break down on the question of finance. The fourth alternative should be very carefully considered, namely, a body of trustees incorporated by Parliament to form a trust on the lines of the Mersey Dock and Harbour Board, in which the traders' interests would predominate, but which did not rule out the possibility of the local authority having representation. In such a trust there were no shareholders and no dividend. Money was raised on the business that was done, *e.g.*, in the case of the Mersey Docks and Harbour Board on the trade of the port. Where a municipal board was set up, provision should be made to limit profits being handed over for the relief of rates. Where a company board was set up, there should be an effective limitation of dividends provided by statute. He would rule out State ownership and control absolutely. It was essential that they should have the same type of board for every district. Regard should be had, as far as possible, to the paramount interest, and therefore, seeing that in Lancashire municipalities predominated so much—only 10 per cent. of the electrical output for the whole of Lancashire was sent out by companies, and the remaining 90 per cent. by municipalities—Lancashire should be municipal, whilst the North-East Coast should be company. The principle of public ownership should be adopted as the basis on which to build up a new and truly national system over the whole of the country, whatever might be done in certain parts as regards operations. In this connection he would again refer to Mr. Gemmell's pamphlet. It was one of the most scathing documents on company enterprise, and if it was wrong, no time should be lost in refuting it absolutely; if it was right, then, in his judgment, it would have dealt a heavy blow to private company enterprise.

The report closed with the pious hope that State assistance might be invoked in connection with the establishment of a national system, but it did not give any clue as to the manner in which it considered that financial assistance should be given. Was the State going to advance capital to equip these super power stations? He held that much more effective assistance could be given (if the State had any money to give away) if it were applied to writing off a debt on obsolete plants, which undoubtedly existed in many stations; in any case, there was a very big outlay to be faced. That of itself would militate against any very early drop in the price of electricity.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

The annual general meeting of the B.E.A.M.A. was held at the offices of the Association on February 28th, when the report and accounts for the financial year ending September 30th, 1917, were adopted. We mentioned in our last issue the names of the five firms elected to fill the vacancies on the Council.

The Chairman referred to the previous report recording the appearance of the B.E.A.M.A. representatives as witnesses before the Committee appointed by the Board of Trade "to consider the question of the Electrical Trades after the War." The report of that Committee had been long delayed and had not yet been published; but he did not think he would be committing any breach of confidence in stating that he believed the report was a very strong one, and that it would be received with gratification by the industry, particularly as it was understood to speak largely along the lines of the B.E.A.M.A. evidence. Turning to the work of the Association during the past session, the Chairman said that two important reports in which the industry was interested had made their appearance. The first was that of Lord Buckmaster's Committee on Pre-War Contracts (Cd. 8975) which, he regretted to say, appeared to afford little direct practical help to contractors, but, in traversing old ground, offered some new suggestions of which, failing Government action, they might be able to avail themselves. The second was the Coal Conservation Sub-Committee's Report (Cd. 8880). This deserved their very careful attention, and would, he hoped, shortly be the subject of action by the Association. As to B.E.A.M.A. conditions of contract, it was satisfactory to record that less difficulty in settling contracts was experienced and their conditions were making steady headway. The subjects of research and education were in their front line of action, and he looked for rapid progress as soon as the Research Department had settled into its stride and the Education Bill had been advanced. Standardisation had made satisfactory progress during the year. As to other matters, they were in close touch with the work of the Federation of British Industries and the British Empire Producers' Organisation, and it went without saying that they were working jointly in many matters with their old friends the E.S.C., the I.E.E., and the C.M.A. The Articles of Association had been entirely recast and the B.E.A.M.A. was now an Association for manufacturers exclusively, the classes of "Associate Member" and "Associate," consisting chiefly of factors, having been cut out. The Chairman concluded his remarks with some words of high approbation of the work of the permanent staff of the Association and with the announcement that the Council had conferred upon the secretary the additional title of "Director."

The report, which was adopted unanimously, stated that the number of members on the register at December 31st was 178; 33 firms were admitted to membership during the year, and one resigned. Members had been fully engaged in the production of war material. They had given their best efforts, and they hoped that the experience gained under the pressure of war requirements would assist towards the development of increased production at the conclusion of hostilities.

While the export trade continues to be necessarily restricted, it has been possible to maintain certain overseas connections, and in some instances to supply the demands hitherto met from enemy sources. This has been rendered practicable on the one hand by means of rations of metals granted to the Association under special priority permits for the manufacture of apparatus for export, and, on the other hand, by licences granted to the Association for the import of materials equally essential to manufacture.

The Overseas Committees have been engaged in consolidating previous work, and standard conditions of contract are being more extensively used by Government Departments and Municipalities, especially in Australia and South Africa, as a result of their activities. The Australia Committee has been of assistance in connection with income-tax and import duties and has made valuable reports on the question of America and Japanese competition. Similar reports have come from the South Africa and India Committees, and it is hoped that, acting on the advice of the Main Export Committee, the Overseas Committees will be able to secure that some form of control over the importation of foreign accessories shall be enforced similar to that exercised by the Licensing Committee in this country. As a result of action taken by the Australia Overseas Committee, the conditions of certain contracts for the Victorian Railways have been modified to give British at least an equality of opportunity with American, Japanese, or other foreign manufacturer.

The question of the piracy of trade marks has also been taken up with the Dominion Governments.

The South Africa Committee is co-operating with the local Standardisation Committees of the E.S.C., and also with the Association of Municipal Electrical Engineers (Union of South Africa), in standardising rules and regulations for electrical supply. This Committee has also supported the action of the local Chamber of Commerce in proposing to the Government that in any new leases granted in connection with East Rand Gold Mines, clauses shall be inserted providing that the lessees shall not place any handicap on British manufacturers. A member of this Committee is chairman of the Electrical Section of the Johannesburg Chamber of Commerce, thus ensuring co-operation between the two bodies in matters affecting the welfare of the British electrical industry in South Africa.

In India, owing to the action of the local Overseas Committee, there is a growing tendency to favour British electrical manufactures.

Useful reports have been received from the Argentine Overseas Committee, and, largely owing to their initiative, a strong Electrical Sub-Section of the Chamber of Commerce has been formed, one of the members of the Overseas Committee being the first chairman. The Committee is also working in close co-operation with H.M. Commercial Attaché, who has attended several of its meetings.

Owing to the disturbed condition of Russia, the activities of the Overseas Committee in that country are naturally restricted.

Several of the Association's recommendations to the Board of Trade Electrical Trades Committee in 1916 have been embodied in the recently-created Department of Commerce and Industry, in particular in regard to a larger number of Trade Commissioners and Commercial Attachés being appointed and their status being raised. The three Trade Commissioners since appointed to represent this country in Australia, India, and South Africa were invited, before taking up their new duties, to meet the Export Sub-Committee charged with the duty of considering overseas organisation. As a result of this conference it is anticipated that a closer degree of cooperation than hitherto will be maintained in the future between the Trade Commissioners and the Overseas Committee of the Association.

The position of Trade Commissioners in Overseas Dominions cannot yet, however, be regarded as entirely satisfactory. Reports have been received from the Australian Overseas Committee contrasting very unfavourably the position of British Trade Commissioners with that of American Commercial Attachés.

The report refers to work done in the interests of British manufacturers in regard to Dominions income-tax and Dominions import duties.

(*To be concluded.*)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

3,772. "Regulating devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 4th.

3,788. "Diaphragm for sound-recording and reproducing machines, telephones, &c." H. A. McInnes. March 4th.

3,793. "Magneto-electric pocket lamp." E. Jaquemot & M. A. Pattay. March 4th. (Switzerland, May 29th, 1917.)

3,803. "Telephone transmitters." J. Eck & Photector Co. March 5th.

3,804. "Telephone mouthpieces." J. Eck & Photector Co. March 5th.

3,824. "Dynamo-electric machinery." E. Greenhalgh, B. Longbottom and Lo-Thermo Patents, Ltd. March 5th.

3,829 3,830. "Conversion of basic or heat energy contained in energy-carrying fluids into electrical energy." F. Hamer. March 5th.

3,837. "Mine signalling apparatus." C. King & W. Smith. March 5th.

3,840. "Electric cells and batteries." R. S. Baxter. March 5th.

3,842. "Apparatus for electrical separation of suspended particles from gaseous bodies." H. C. Bingham and Huntingdon, Heberlein & Co. March 5th.

3,846. "Electric switching devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 5th.

3,848. "Electric switches." British Westinghouse Electric & Manufacturing Co. & F. B. Holt. March 5th.

3,854. "Electric switch for control of internal-combustion engines." W. D. Meagher & T. H. Ratcliffe.. March 5th.

3,856. "Electric batteries." G. N. Antonoff. March 5th.

3,869. "Magnetos." Compagnie Generale Magnetos. March 5th. (France, May 4th, 1917.)

3,870. "Magnetos." Compagnie Generale Magnetos. March 5th. (France, May 3rd, 1917.)

3,878. "Adjustable electric resistances." R. K. Hearn. March 6th.

3,883. "Mechanism for regulating electrodes of electric furnaces." V. F. Turner & J. Walker. March 6th.

3,890. "Terminals for electric dry cells, &c." W. A. S. Hellyar. March 6th.

3,913. "Arc lamps." G. Gautier, A. Garbarini & L. Mauclaire. March 6th. (France, October 13th, 1917.)

3,918. "Electric transforming and converting apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 6th.

3,920. "Electric accumulators" G. P. Pearson. March 6th.

3,925. "Number dials for automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., J. E. Collyer, G. W. Moore, Siemens Bros. & Co., and Western Electric Co. March 5th.

3,951. "Electromagnetic lock-out switches for motor control systems." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 6th.

3,952. "X-ray tube stands." E. C. R. Marks (Reid). March 6th.

3,963. "Telephone receiver earpieces." A. C. Brown. March 6th.

4,000. "Internal-combustion engines having electric ignition." R. W. Maudslay & Standard Motor Co. March 7th.

4,017. "Mechanism for varying point of ignition in magneto-electric ignition apparatus." Akt. Ges Brown, Boveri et Cie. March 7th. (Germany, March 23rd, 1917.)

4,025. "Electric heating elements and resistances." C. O. Bastian. March 7th.

4,026. "Electrically-heated clothing, &c." C. O. Bastian. March 7th.

4,039. "Armatures." Compagnie Generale de Magnetos. March 7th. (France, May 5th, 1917.)

4,040. "Ignition circuits of magnetos." Compagnie Generale Magnetos. March 7th. (France, September 29th, 1917.)

4,044. "Circuit-breakers for ignition magnetos." Soç. Labrosse et Esteve. March 7th. (France, September 6th, 1917.)

4,045. "Electric light bracket fittings." M. J. Railing & T. Taylor. March 7th.

4,057. "Wireless telegraphy and telephony variable tuning condensers." E. E. G. Boite. March 8th.

4,058. "Electric current collectors." A. Barham. March 8th.

4,059. "Signals for mines, &c." H. Drabble. March 8th.

4,060. "Electrical means for detecting presence of metal masses." E. W. Marchant. March 8th.

4,064/4,065. "Dynamo-electric machines." Lancashire Dynamo & Motor Co. & H. B. Whitmore. March 8th.

4,073. "Sparking plugs." J. Puerto & C. R. de Tassigny. March 8th. (Spain, March 17th, 1917.)

4,074. "Double plug ignition means for internal-combustion engines." R. W. Stanfield. March 8th.

4,085. "Electrolytic cell." F. A. Brown & J. Morton. March 8th.

4,086. "Combined electric air-speed and turning indicator." H. C. Weston. March 8th.

4,090. "Safety devices for elevators, &c." Waygood-Otis Co. (Otis Elevator Co., U.S.A.) March 8th.

4,091. "Brake-controlling devices for electromagnetic brakes, &c." Waygood-Otis, Ltd. (Otis Elevator Co., U.S.A.) March 8th.

4,120. "Heating conductors of thermic-telephones." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 8th.

4,125. "Trip-cancelling switch." Sterling Telephone & Electric Co., Ltd., F. G. Bell & W. C. Davey. March 8th.

4,131. "Electro-mechanical power transmission systems." Leyland Motors, Ltd., & J. G. P. Thomas. March 8th.

4,147. "Means for making and breaking electric circuits." W. A. Brame. March 9th.

4,153. "Arc-controlled mechanism for electric arc furnaces." W. J. Poole. March 9th.

4,163. "Device applicable to magnetic compasses and for use in compass readings." W. H. Woods. March 9th.

4,189. "Electric plug receptacles." W. Ile & H. Fairbrother. March 9th.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

17,526. Electric Annunciator Systems for Calling Attendants. E. E. Rogers. December 6th, 1916. (113,291.)

1917.

196. Shock-resisting Winding for Rotating Magnet Coils. Vulkan Maschinenfabriks Akt. Ges. May 24th, 1916. (Addition to 3,919/12.) (106,992.)

538. Apparatus for Electric Welding. J. Crichton. January 11th, 1917. (113,293.)

807. Lamps or Lanterns for Light Projectors, such as Searchlights, Headlights, or the like Apparatus. H. Scholey (Soc. Anon. des Phares et Lanternes Tub.). January 16th, 1917. (113,296.)

2,103. Electromagnetic Brake. H. V. James. February 12th, 1917. (113,308.)

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INSTITUTION PROCEEDINGS.

"THE times are changed"—very radically changed; and it is satisfactory, as well as interesting, to observe how the Institution of Electrical Engineers is changing with them. In days gone by, when Dr. Ferranti was at the helm, and addressed his classic exhortation to the Institution to be up and doing, we thought a change was imminent, but the forces of reaction were too strong, and the impulse was damped out, together with the Industrial Committee, which proved to be too far out of phase with the Council of pre-war days to be other than a wattless component of its working. But now a fresh impulse has been received from the world-war, and circumstances have so far changed that the scheme outlined by Dr. Ferranti, if not within measurable distance of fruition, is at least visible upon the horizon of the electrical world; and the Council of the Institution, cautiously and somewhat gingerly, is feeling its way towards a wider view of its responsibilities and a more effective participation in industrial affairs. No doubt the improvement in its attitude has been largely due to guidance from the presidential chair, and the Institution has been fortunate of late in a succession of energetic and open-minded leaders in that capacity whose influence has been wholly salutary. Its present occupant "made good" at the start, and although Mr. Wordingham in his presidential address seemed somewhat nettled by past criticism of the Council in the electrical Press, he outlined a programme of progress and reform on remarkably similar lines to those which the Press has persistently advocated, and shows every sign of determination to carry it into effect.

Already he has initiated a movement towards the realisation of his long-cherished aim to establish a National Proving House; he has successfully inaugurated, in spite of the difficulties of the times, the informal dinner after the ordinary meeting, which bids fair to become a permanent feature of the proceedings; he has taken steps to improve the discussions at the meetings, and under his *régime* the rules for wiring ships, the prosecution of research, the reform of the Patent Law, and other important matters are being pushed forward.

The forthcoming joint meeting of the Institution with the Electrical Section of the Royal Society of Medicine, accompanied by an exhibition of apparatus, gives ground for hoping that henceforth, by co-operation between the two professions concerned, electromedical appliances, which in the past were mainly imported from Germany, will be manufactured wholly in this country. Our regrettable neglect of this important branch of the industry was pointed out by the late Mr. Duddell in his presidential address in 1912; it was, we believe, largely due to the predilection of the medical profession for foreign-made apparatus, but here, again, the war has effected a welcome change of attitude.

A notable feature of the meetings of late has been the curtailment of the reading of the papers by the authors, who have limited themselves to a brief summary of the contents. We have often urged that the main purpose of the meeting is not to listen to the reading of a paper, which can be read to greater advantage elsewhere, but to discuss the subject dealt with, as fully as possible, and we have pointed out that the American Societies issue their papers, or even publish them in the Press, long before the meetings, to facilitate full discussion. In these times of paper scarcity we can no longer advocate the distribution of copies of the paper broadcast in advance, but members interested can usually obtain them on application to the Secretary, and it seems obvious that the time thus saved at the meeting should result in greatly improved discussions, which would no longer be confined to a few experts. Perhaps Dr. Barclay, at the meeting on Thursday last, carried the new practice to an extreme when he read no part of the paper whatever; but, on the other hand, the address which he gave, with the aid of excellent lantern slides, on the microstructure of steel and the behaviour of that metal under various conditions was of such absorbing interest and so admirably delivered that we feel sure the audience were more than satisfied with the innovation. The Institution is certainly to be congratulated upon the remarkable excellence attained by the majority of the papers of the current session, and upon the progressive spirit which has of late been manifest in its proceedings.

Legislation in Austria.

A Bill has been introduced by the Austrian Government in the Lower Chamber with the object of regulating, among other matters, the establishment and working of electricity supply stations. On the submission of the Bill, the Minister for Labour expressed regret at the country's lack of progress, which is shown by the inadequate utilisation of water power, the lack of system in carrying on the industry, and the preponderance of small stations over the large works. He stated that if the water powers were appropriately used it would be possible not only to economise largely in the consumption of coal, but also to be free from the necessity for importing coal from Germany, and, in fact, more coal could be exported to the latter country. The leading idea of the Bill is to provide a system of electricity administration, and, at the same time, to guarantee the requirements of the State and the general community.

The Bill stipulates that a concession must first be obtained to authorise the delivery of energy to third parties, the concession giving the right of erecting conductors, and being capable of extension so as to confer the right of expropriation. A limitation of areas of supply is fixed in order to ensure systematic methods in the supply of electricity. The State may grant financial assistance to the undertakings in return for the State being given an influence in the management of the business. The promoters of works who apply for facilities in excess of those conferring the right of erecting conductors will be subject to the State participating in the profits and the lapse of the concession after 25 years, when the undertakings will revert to the State, provided that the concessions are not renewed. In these cases the State, after the undertaking has paid 6 per cent. on the ordinary share capital, will receive one-third of the profits up to 10 per cent., and one-half of the profits realised beyond this percentage. The Bill further makes provision for the prevention of any monopoly in the installation contract department.

Saving Fuel.

At the conferences which have been held recently in various centres by the Tramways Committee of the Board of Trade, the subject of economy has naturally assumed considerable prominence, and suggestions have been made for the relief of the tramway services by distributing the traffic at busy hours over a longer period. This has been accomplished to some extent in certain cases, but a good deal remains to be done, and some useful hints may be derived from the report of a committee appointed by the Electric Railway War Board to investigate the possibilities of fuel economy on the tramways of Washington, U.S.A., recently published in the *Electric Railway Journal*. The Committee estimates that an annual saving of no less than 25,790 tons of coal can be effected, whilst actually improving the service to the public. One-third of the saving is ascribed to a reduction in the number of stops, partly by extending the distance between stopping places, and partly by adopting the "skip-stop" plan, according to which alternate cars on a given route miss, say, every other stop—an idea which is already to some extent in vogue on the London Electric Railways. It is estimated that in Washington the number of stopping-places can be reduced by 40 per cent., and the actual stops by 25 per cent., compared with those made at present, without any hardship to the public; there would then be about eight stops per mile, and no-one need walk further than about 400 ft. at most.

Reducing unnecessary mileage in non-rush hours, by running short-stage cars in busy parts, and adopting a longer headway in the outlying districts, offers a possible saving of 3,000 tons of coal. By transferring the traction load to the most economical generating station a further economy is made of nearly 10,000 tons, and, lastly, the plan of "staggering" the office hours of Government departments at 15-minute intervals, over a period of three-quarters of an hour, is expected to bring about a small reduction in fuel consumed, besides reducing the number of cars run during the rush hours and the amount of generating plant required.

A similar investigation was carried out at Rochester, U.S.A., by the New York State Railways; the industrial conditions of the city were studied, and with the hearty co-operation of the local manufacturing firms a schedule of "staggered" opening and closing hours for the various establishments was drawn up, which enabled the use of 20 to 30 cars to be discontinued during the rush hours. This plan has been successfully adopted here also to some extent, and is advocated by the Board of Trade Committee. Drastic curtailment of both tramway and railway accommodation in the near future is foreshadowed by the Government, but evidently there are also other methods of effecting material economies, which should not be overlooked.

In the same issue of our contemporary, particulars are given of the construction of a "super-station" of 200,000-kw. capacity at Windsor, U.S.A., jointly by two companies, with a view to securing the advantages of large generating sets (six of which will be installed), an improved diversity factor, and proximity to coal and water supplies. It is anticipated that the cost of energy from this station will compare favourably with that of the large hydro-electric stations in the West, which distribute their output over long distances. An exceptional advantage in this case is the convenient situation of the time zones, which change by one hour at a meridian near that on which the power station is built, thus benefiting the diversity factor in a way which is not practicable here.

NOTES ON ELECTRIC LOCOMOTIVES.

In connection with the design and construction of electric locomotives for passenger and goods trains a considerable amount of valuable information has been accumulated as a result of many experiments carried out on the Continent. More experimental locomotives have been built and tested on the Continent of Europe than anywhere else. Taking the Midi Railway, in France, for instance, no fewer than six firms were invited to submit locomotives for trial on the line extending from Villefranch to Ille, but only three of the competing firms were successful in getting their locomotives accepted. All the locomotives submitted were of the 1—C—1 type, having three driving axles and two idle axles. In one case power was transmitted from two independent motors placed closely together in the cab by means of two sloping connecting rods, each motor driving through these rods a separate jack shaft located at each end of the locomotive next to the outer driving wheels, and the jack shafts were connected to the driving wheels by means of horizontal side rods.

A second locomotive was driven in practically the same manner, the main difference in the two cases being in connection with the electrical equipment. A third type of locomotive also had two motors, but instead of being connected to a jack shaft, they were connected together through a triangular rod arrangement, the lower point of which engaged with the crank on the middle driving wheel, and the other points were coupled to the cranks on the two motors. This design, however, was afterwards abandoned. Another of these locomotives was of the geared side rod type, equipped with two motors each geared to a jack shaft placed well down between the driving wheels, the power being transmitted from the jack shaft cranks to the centre wheel by means of a triangular Scotch yoke, and from there by side rods to the two outer driving axles. The most powerful locomotive had three motors, one over each axle, and geared to a quill surrounding the axles, the quill being joined to the wheels by a flexible coupling. The locomotives accepted were those driven in accordance with the first, fourth and last-mentioned methods, and the leading particulars of these engines are given in the following table :—

	French Thomson-Houston.	French Westinghouse.	Construction Electriques du Nord et de l'Est (Jeumont).
Total weight (tons)	88	81	80
Length (M)	13·75	11·37	15·27
Wheel base (M)	9·6	8·8	10·6
Diameter of driving wheels (M)	1·3	1·2	1·4
Number of motors	2	2	3
H.P. of motors	600	600	500
Method of drive.	Coupling rods driving two jack shafts.	Gearing and Scotch yoke.	Motors geared to each driving axle.

Each of the three above firms received orders for eight additional locomotives, but they were not, it has been reported, to be exact duplicates of the original locomotives. The new locomotives were to have three driving axles and two idle axles, each driving axle being driven by two motors geared to a quill surrounding the axle, an arrangement which has been adopted with marked success in America.

It is not so much in connection with electrical designs that many Continental locomotives have proved unsatisfactory. The main troubles have originated from the transmission arrangements between the motors and driving wheels. On the Continent there has been a distinct tendency to adhere, as far as possible, to steam locomotive practice, the original idea being merely to replace the boiler and fire box of the steam locomotive with an electric motor, and to retain, as far as possible, the ordinary driving arrangements. It has been customary in many cases to transmit the power from the motor or motors to the driving wheels by means of rods and a jack shaft, and often without gearing. This plan has been adopted on many Continental railways besides the Midi Railway—as, for instance, on the Dessau-Bitterfeld line in Germany. For high-speed passenger traffic on the latter line a type of engine designated 2—B—1 has been adopted—that is to say, a locomotive having two leading axles, two driving axles, and one trailing axle. Cranks at the end of the motor shaft drive a jack shaft through vertical connecting rods, and from this jack shaft the driving wheels are driven by ordinary horizontal side rods. Breakages of the crank and jack shafts have been experienced, however. The jack shaft in this type of locomotives is subjected to a series of suddenly applied reciprocating tension strains, and these strains, it is believed, were accountable for the breakages. Great accuracy in the alignment of bearings and liberally proportional shafts are essential with locomotives constructed on these lines, but doubts have been expressed, especially in America, as to whether these precautions will entirely eliminate the trouble.

Although, apart from the crank shaft and jack shaft breakages, these locomotives have given pretty good results, it seems improbable that this type of engine will be used in future for high-speed traffic. In fact, it was decided some time prior to the war to test the 1—C—1 type, that is, a locomotive having three driving axles and two idle axles. Like the 2—B—1 locomotives, there was to be one motor placed high up in the body, but, instead of the connecting rods between the motor shaft and jack shaft being vertical, they were to slant, as on various other locomotives, at an angle of about 45°. Slanting connecting rods were used on the original Dessau-Bitterfeld goods locomotives, which, of course, run at much lower speeds, but not on the original locomotives intended for passenger service. So far as can be gathered, the tendency is, or rather was, prior to August, 1914, to slant the connecting rods as much as possible.

The experimental goods locomotives put into operation on the Dessau-Bitterfeld line were O—D—O locomotives, having four driving axles coupled and no other axles. These locomotives weigh about 70 tons, and are designed for a normal speed of 15·5 miles an hour, a speed that is not likely to lead to trouble. Despite this, however, a number of firms were invited to submit locomotives for the goods service, and it was specified that these engines should have a high centre of gravity.

For low and medium speeds the B—B Continental engine has, it seems, given pretty good results. This locomotive has two independent trucks, each having two driving axles, and on each truck a single motor is mounted, and it is geared to a jack shaft, which in turn is connected to the two driving axles on the truck that carries the motor by means of Scotch yoke.

Many of the high-speed direct-drive side-rod locomotives have given more or less trouble as the result of vibration at critical speeds, and crankshaft and jack shaft breakages have not been at all uncommon. The 1—D—1 type of locomotive built for the Silesian lines developed trouble of this kind, and it has been reported that this type was to be abandoned. The original 1—D—1 Silesian locomotive weighed over 100 tons, and had two large motors connected through slanting connecting rods to a common jack shaft coupled to the driving wheels with horizontal rods.

In place of this type of locomotive it was proposed to employ locomotives having two motors, each rated at half the output of the original single motor and with intermediate toothed gearing.

Among other Continental locomotives is the C + C type, with two three-axle trucks, each of which is equipped with two motors geared to a common jack shaft, which drives the three axles through horizontal side rods. Again, there is the B + B + B locomotive, with three two-axle trucks. Each truck carries a motor which is geared to a jack shaft, the latter driving the two axles through horizontal side rods. A type similar, so far as the trucks are concerned, is the A A + A A + A A locomotive; but in this case each of the three trucks carries two motors, and each motor is geared directly to one of the axles.

For the Silesian State railway a 2—D—1 locomotive with one large motor was designed, the drive being similar to that adopted, in the first place, on one of the Midi railway locomotives. Power from the motor is transmitted to a pair of jack shafts through a triangular rod arrangement, the upper point of which is connected to the motor crank, whilst the base connects together the cranks of the jack shafts, which in turn are connected by horizontal side rods to the driving wheels. In the case of the Midi railway locomotive, however, there were two motors connected to the driving wheels through a triangular rod, the apex engaging with the crank on the centre driving wheel and the base connecting together the cranks of the two motors.

On the Löetschberg railway, in Switzerland, several methods of driving have been tried. The first experimental locomotive put into service on this line was of the articulated type, with two motors, one erected on each half of the engine, and each motor drove a jack shaft through a slightly slanting connecting rod, and this jack shaft was in turn connected to the driving axles through horizontal rods. The next experimental locomotive had two three-axle trucks, each carrying a motor geared to a jack shaft coupled to the three driving wheels by connecting rods and the usual side rods. The jack shaft is placed so low that the connecting rod makes a very small angle with the horizontal. In this case the motors are placed at the extreme end of the locomotive, but in a later design they have been shifted to the centre. It is believed, although nothing definite has been published, that at the high speeds this locomotive was rather hard on the track. In any case the driving arrangements in the latter, and more powerful, locomotives are different. These latter locomotives have five driving axles, instead of six. Three of these driving axles are fixed in a rigid wheel base, whilst each leading truck at the ends has one idle axle and one driving axle. On all these trucks the two driving axles are held parallel to one another, and are connected together by means of horizontal side rods. As stated above, the two motors are placed close together in the centre of the cab, and are geared to jack shafts, which in turn are connected to the centre driving wheel by a Scotch yoke to which the horizontal side rods are coupled.

There are, of course, other types of electric locomotives, but those referred to are fairly representative of Continental practice. In many cases where rods and jack shafts are used, vibrations and oscillations have been produced in the driving mechanism at certain speeds, and in some cases these vibrations and oscillations have proved sufficient to break rods, crankshafts, and yokes. By careful adjustment of bearings, it has been possible in some instances to eliminate these defects, but these adjustments involve labour and loss of time, and it has been found that shortly after such adjustments had been made, the trouble has again manifested itself. Not infrequently locomotives have been put out of action as the result of excessive vibration at certain speeds. Even the Pennsylvania Railroad locomotives are said to have developed faults of this kind, although in this case the trouble has not been serious. Up to a point this vibration increases as the speed rises until the resonance point is passed, when the vibration ceases. Especially has this effect been noticeable with locomotives having two motors driving through connecting rods on to a common jack shaft, and it has also been observed on some engines with geared motors driving the wheels through a Scotch yoke.

At first sight it appears strange that the rod drive should give rise to trouble on an electric locomotive, and not on one that is propelled by steam. But it must not be forgotten that the conditions in the two cases are not exactly analogous. The driving system in the steam locomotive terminates in the steam cylinder where the elasticity or cushioning of the steam compensates any inaccuracy to the construction. The inelasticity of the driving system of an electric locomotive is intensified where the heavy rotary members of the two independent motors are connected together by a system of rods.

In the design of high-speed locomotives for passenger service, American engineers have in the main proceeded along different lines to those adopted by engineers on the Continent. Various kinds of transmission systems have been adopted in America with a view to providing elasticity between motors and driving wheels. Locomotives have been built with the motor armature surrounding the driving axles, but coupled to the wheels through heavy spiral springs, this being known as the quill drive previously referred to. A more modern arrangement is to gear the motor to a quill surrounding the axle, the quill, as in the first-mentioned arrangement, being connected to the driving wheels by means of long spiral springs.

This design has been embodied in the latest type of locomotive put into service on the New York, New Haven, and Hartford Railroad. When the motor armatures surround the axles, the centre of gravity is, of course, low, but the springs introduce elasticity and prevent the truck receiving direct blows. The motors, however, are now placed above the axle and drive gears mounted on the quill. This type of engine has a high centre of gravity, and the quills are so spaced that they have total play of 3 in. above the axle (1½ in. above and below), which allows for irregularities in the rails. Locomotives driven in accordance with this arrangement have been built with a single motor per axle, and with twin motors for each axle, the combined capacity of the two motors being the same as that of the single motor arrangement. After a number of locomotives had been constructed with very large motors, necessitating the use of double gears, it was found that the same output could be obtained with less weight, and at less cost, by substituting two motors for one of larger size. Various advantages have been secured by adopting this arrangement. First, only one gear is required, as both motors drive through the same spur wheel; secondly, the two motors are said to be lighter, more easily handled, and cheaper to maintain; thirdly, on the New York, New Haven, and Hartford system the locomotive armatures are interchangeable with those on the motor coaches; fourthly, as the two motors are connected in series, the combination is equivalent to a single motor of twice the ordinary voltage, and, consequently, only half the amount of current has to be dealt with as compared with that taken by a single locomotive of the same output as the pair.

It will be seen, then, that modern American practice differs considerably from that in vogue on the Continent of Europe prior to the war, but judging from various reports that have been published, many of the Continental locomotives that have been described in technical journals have either been entirely rejected or reconstructed with a view to making the driving system elastic.

ALUMINIUM IN TRANSFORMERS.

These are essentially days of substitutes—many of them nasty and few particularly cheap. A good deal has been heard lately concerning the use of aluminium as a substitute for copper in transformer windings. Striving to make a virtue of necessity, M. Vidmar writes in *Elektrot. u. Maschinenbau* claiming certain advantages for aluminium which cannot all be substantiated. On the other hand, the substitute metal has certain useful characteristics which deserve to be considered, though it is doubtful whether aluminium is likely ever to be used in genuine preference to copper for transformer windings.

Since the electrical resistance of aluminium is about 70 per cent. greater than that of copper, more space is needed to accommodate aluminium windings, which have, however, the advantage of lower weight for equal conductance. If aluminium be substituted for copper windings, the transformer output for equal losses is reduced by 23 per cent. On the other hand, if the cost of the winding in a copper-wound transformer be one-third the total cost, the cost with aluminium windings is about 19 per cent. lower. In an air-cooled transformer, the copper cost is generally more than one-third of the total, and the economic advantage of an aluminium winding is correspondingly increased.

Vidmar makes certain assertions concerning the cooling of subdivided or disk windings which are criticised adversely by A. Hundt in *Elektrot. Zeitschrift.* Vidmar asserts that in an air-cooled transformer, heat is dissipated from the flat sides of the winding sections by radiation alone, and that the whole heat loss is not greater than it would be from a single cylindrical winding of equal total length and periphery. He states also that heat dissipation is more favourable when the air space between winding sections is horizontal than when the plane of the coils is vertical. Assuming the truth of these assertions, the space between winding sections may be utilised to accommodate the larger aluminium winding, leaving the power, losses, and heating unaltered (compared with copper windings.)

Hundt points out that Vidmar's case for the advantages of air-cooled aluminium transformers depends on the cooling phenomena which he adduces. Actually, however, convection plays a considerable part in removing heat from the flat sides of disk coils, and the air spaces between the latter should be vertical (*not* horizontal) for maximum cooling effect. The temperature rise in a 60-K.V.A. A.E.G. air-cooled aluminium-wound transformer was 78° C. with the air spaces set horizontally, and only 57° C. with the air spaces vertical. With the former arrangement, the output for 57° C. temperature rise would be about 50 K.V.A. If the air space between sections were sacrificed to accommodate the larger aluminium winding in the same over-all space as a normal copper winding, the temperature rise would be yet more serious. In this connection it may be mentioned that Vidmar leaves air spaces between the coil-sections of a 100-K.V.A. aluminium transformer which he has built.

Vidmar estimates that an aluminium transformer is 14 per cent. cheaper than a copper transformer when aluminium is 40 per cent. dearer than copper, weight for weight; the cost of the transformers is the same when aluminium is 1·94 times as dear as copper. Even then the aluminium transformer is lighter. For equal cost an aluminium transformer yields, it is claimed, 17·5 per cent. greater output, but this figure depends partly on the questionable cooling assumptions noted above. An air-cooled aluminium transformer made by Vidmar for 12,500/165 V., 42 cycles, weighs 800 kg., including 524 kg. of active iron and 98 kg. of aluminium.

The space factor of the windings in an air-cooled copper-wound transformer may be about 0·14, compared with 0·3 in an oil-cooled transformer. On this basis, an aluminium-wound transformer requires 0·14 × 70 = 9·8 per cent. greater winding space for air cooling, and 0·3 × 70 = 21 per cent. greater winding space for oil cooling. In a zinc-wound transformer, the advantage of the air-cooled type is yet greater for a similar reason. About 250 per cent. greater section is needed in zinc than in copper conductors for equal conductance, so that 35 per cent. greater winding space is needed in air-cooled transformers, and 75 per cent. greater space in oil-cooled transformers, compared with copper-wound transformers in each case.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

(*Concluded from page 288.*)

The Association has adopted the principles of the new British Standardisation Rules. E.S.C. 72/1917, for export work, and the Association's Export Standardisation Rules, which are an abstract of E.S.C. 72, have now been translated into Spanish, Portuguese, Russian, and Chinese, and are being made use of by members with a view to popularising British standard practice abroad.

Representations were made to both the Board of Trade and the Foreign Office in connection with proposals emanating from enemy countries to export their goods after the war through Switzerland or other neutral countries so disguised as to conceal the source of origin. The Government Departments appear to be now alive to the importance of this question.

Editions of the *Journal* were published in Russian and Spanish.

The I.E.E. Conditions of Contract have, through the instrumentality of the Association, now been firmly established as the standard for the home industry.

The records of the industrial solicitor show that, whilst the number of contracts on which he has been consulted has been about the average, there has been less difficulty in adjusting points of difference.

Arrangements have been completed between the Association and the Institution of Electrical Engineers whereby research into the problems of insulation is conducted jointly by the two bodies, both of which now communicate with the Government Department of Scientific and Industrial Research through a Central Committee established by the Department, and known as the "Electrical Research Committee."

A Committee is considering the question of technical education in its relation to the electrical and allied industries.

Proposals of the Turbine and Turbo-Generator Sections respecting research scholarships are being entrusted to the care of this Committee.

A scheme is also being considered to provide for the formation of central and local Committees to deal with the selection, placing, and training of suitable overseas students.

In the section of the report relating to standardisation it is stated that representation has been established on new committees and panels dealing with the gauging of machine parts and screw threads and the electrical details of ship and aircraft equipment. Representatives took part in the British-American Conference on electrical standardisation.

A Committee has been appointed to study questions of common interest to members relating to estimating and accounting.

The Association gave evidence before Lord Buckmaster's Pre-war Contracts Committee on pre-war contracts the cost of executing which during war time had been greatly increased, and in some cases made impossible of fulfilment.

The Council made representations in the proper quarters as to the desirability of establishing a National Proving House. An expert Committee of the Association is shortly reporting on the report of the Coal Conservation Sub-Committee.

Liberal gifts of machinery and apparatus were made by members to the equipment of the laboratories and shops of Pekin University, but the war has delayed installation, and a final report from the University is not yet to hand.

The Association gave its support to the proposal of the British Empire League for an Empire Trade Mark of Origin, but with the provision that the use of the mark would be a national one, and its misuse by private groups or persons guarded against.

The creation of a co-ordinating board composed of members closely connected with the work of the various sections was successfully carried out during the year, and the board is now devoting close attention to several matters affecting the sections in common. One such subject is that of relief from the burden of contracts entered into prior to the war, and the immensely increased costs which result from wages awards made by the Government and the consequent rise in the cost of raw materials.

Sectional activity during the year has been mainly in connection with matters arising directly or indirectly out of the war such, for example, as metal rationing, the control of imports, the right to export, pre-war contract difficulties, mitigation of difficulties generally under which manufacture is now carried on and business goodwill maintained, &c.; while the general tendency is exhibited in largely increased impulses towards research, standardisation, and education, regarded as national affairs. Directly or indirectly, most sections have come into contact with Government Departments and done much useful work. The Dynamo and Motor Section, for example, confers regularly with the Electrical Power Department of the Ministry of Munitions through an Advisory Committee (created by the invitation of the Ministry to secure economy in working and speeding up), and has obtained, through it, an Order in Council prohibiting the import of motors. Work in the direction of co-operative purchase and the settlement of special conditions with special bodies has been extended during the year.

The articles of association have been amended, limiting the membership to *bona fide* manufacturers, and making alterations in the method of electing the Council so as to give opportunity for fresh representation.

The system of tendering embodied in these agreements continues to find favour among members, but has not been extended during the year.

The work of the Association's status inquiry agents, the British Traders' Association, is under review by the Estimating and Accounting Committee.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Heating Pad.

The Goodwill Electric Co., of 59, East Van Buren Street, Chicago, is offering an electric heating pad for general use, a slight modification of one the company developed for the hospital field. The thermostat is mounted in the centre of the pad in a sealed box 1·125 in. in diameter and 0·25 in. deep. It is composed of two U-shaped arms of half-hard brass and tempered steel, both of which are wound with a continuation of the German silver wire which forms the main heating element. The thermostat is adjusted through a slot in its container, and has a range covering all points between 100° and 180° F. Tendency to short-circuit is overcome by the helical construction, and the manufacturers claim that the current may be turned on when the pad is wet without damage.

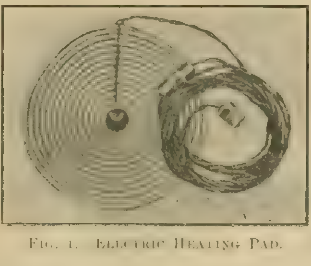

Fig. 1. Electric Heating Pad.

Electric Cooking at a Newspaper Office.

The accompanying illustration shows a neat and compact electric cooking installation which has been supplied by the British Electric Transformer Co., Ltd., of Hayes, Middlesex, to Messrs. United Newspapers, Ltd., the publishers of the *Daily Chronicle*, *Lloyd's Weekly News*, &c., for the benefit of the editorial staff; the apparatus is situated conveniently in a small room adjacent to the dining room, and provides for the preparation of teas in the afternoon and meals for the staff on night duty, about 120 meals being served daily. It comprises the following items, shown in fig. 2, all of which are of the well-known "Tricity" type.

Oven fitted with two ribbed plates, each taking 900 watts on "high" and 225 watts on "low" load—total maximum loading 1,800 watts; duplex cooker for two 2-gallon urns, each plate loaded to 850 watts on "high" and 210 watts on "low"; grill with open element loaded to 800 watts.

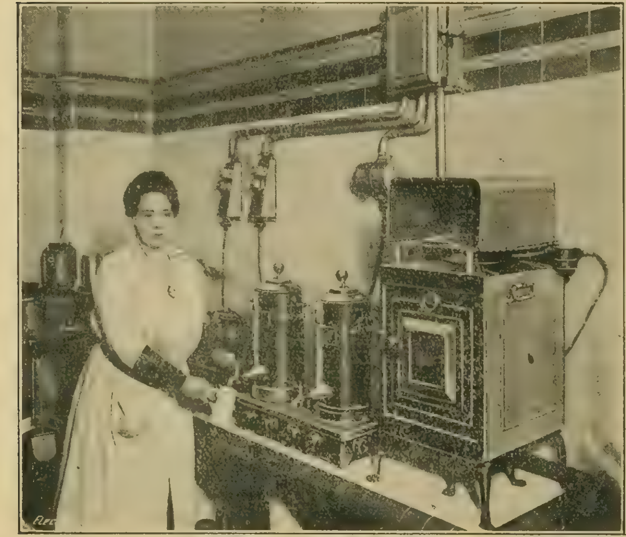

Fig. 2. "Tricity" Kitchen at United Newspapers, Ltd.

The comfort and convenience afforded to the staff by the provision of facilities for electric cooking at all hours need not be emphasised; we are informed that the installation has given every satisfaction, and that its resources have been fully equal to the demands imposed upon it.

An equipment on similar lines, including apparatus for warming up meals brought by the employés, has been installed in another part of the building.

We are indebted to Mr. Mascord, works superintendent, for the opportunity to inspect the installation, and incidentally to make a tour through the building, which is equipped with electrically-driven printing machinery of modern and, in some respects, unique design.

An illustrated description of the plant appeared in our issue of June 3rd, 1910; since that date the lighting of some of the departments has been improved by the substitution of half-watt lamps on the semi-indirect system for the inverted arc lamps formerly used, with excellent results. The mercury-vapour lamps, however, have been retained in the publishing and press rooms, the quality of the light having been found peculiarly suitable for the kind of work done there.

Portable Electric Grinder.

One of the latest tools made by the Sun Electrical Co., Ltd., of 118 & 120, Charing Cross Road, London, W.C., is a portable electric grinder, which will be of great value in all tool rooms for the quick and accurate grinding of centres, reamers, dies, &c. It works equally well on both internal and external jobs, and will grind out holes up to ¼ in. deep.

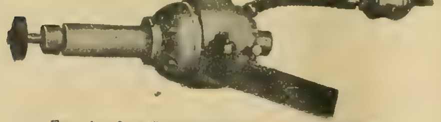

Fig. 3.—Sun Portable Electric Grinder.

The device is very compact, the over-all length being 10¼ in., and the weight only 5½ lb. A fixing arm is attached so designed as to fit into the slide rest of ordinary lathes. The grinder is fitted with a $\frac{1}{12}$-H.P. motor, running at 10,000 revs. per minute, which gives to the emery wheel the right surface speed. The dimensions of the emery wheel are 1¼ in. × ¼ in. × ¼ in.

This grinder is economical to operate, and can be run from any electric light point, being furnished complete with stout workshop flexible cord, fireproof B.C. adapter, and metal-cased switch. The motor is universal, operating on either direct or alternating-current circuits.

Outdoor Sub-station Transformers.

Our illustration, fig. 4, shows an 11,000-volt, three-phase transformer, isolating switch, and fuse, for use in the open air. It is now general practice in America and the Colonies to dispense with buildings for transformer sub-stations used in conjunction with overhead transmission lines. Static transformers can be designed with their protective switchgear to withstand complete exposure to the weather under all usual climatic conditions, and they require no attendance beyond occasional inspection.

Messrs. Johnson & Phillips, Ltd., of Charlton, London, S.E. 7, have therefore designed, both for the foreign and Colonial markets, and in view of developments in this country, a series of outdoor transformers, similar to that shown. A number of these units have been in use for a considerable time abroad, and reports prove their entire success.

This design is used for units of 50 k.v.a. and upwards, the larger transformers ranging up to 22,000 volts; the one illustrated is designed for a voltage of 11,000, three-phase.

The protected terminals are arranged to take bare connections from E.H.T. overhead transmission lines, and the transformers are oil-immersed, the insulators being designed to stand from two to three times the working voltage when wet. By removing the lid of a hand-hole in the cover all connections become easily accessible.

The weight of the transformer is supported by a platform, and suitable straps are provided for steadying purposes. The makers supply, if desired, details of a suitable supporting structure.

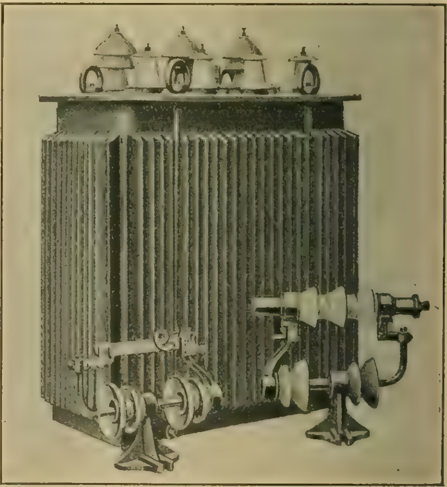

Fig. 4.—J. & P. Outdoor 11,000-volt Transformer.

An Automatic Electric Iron.

An electric iron equipped with a switch which opens automatically when the iron is not in use is announced by a United States manufacturer. A switch button is provided in the forward part of the handle, just where the thumb ordinarily rests. Under normal ironing conditions, the thumb presses against the switch button and keeps the iron in circuit; removing the thumb cuts it out of circuit. By means of this switch button, the current may be cut in and cut out at will by the operator, merely by moving the thumb. This will be found convenient when ironing the lighter fabrics, the heat being shut off when not needed, to prevent scorching.—*Canadian Electrical News*.

"Carron" Cookers at the Engineers' Club.

We recently recorded the fact that the Engineers' Club, Manchester, had substituted electric for gas cooking plant, and was highly satisfied with the results. We are now enabled to give some particulars of the apparatus, which was supplied by Carron Company, Stirlingshire, and installed by Messrs. Sharples Hill and Co., of Manchester. Fig. 5 shows the apparatus, which has been constructed from various standard Carron parts, and consists of a hot closet, boiling table, bain marie, oven, and grill, with a smaller hot closet over it, the whole being fitted up complete with switchboard and arranged for a central situation.

The main hot closet measures 6 ft. long × 2 ft. 6 in. deep × 2 ft. 9 in. high; it has sliding doors on one side, and is fitted with two shelves, making three compartments; there are four separate sets of heating elements in the bottom compartment, arranged for various degrees of heat regulation. In the hob or top of this hot closet are fitted various boiling sections at one end, and a bain marie measuring 27 in. × 24 in. × 4 in. at the other; the total loading of the boiling sections is 6 kw., and that of the bain marie 3 kw., all the elements being arranged for heat regulation. A strong draw-off tap, with cleaning nozzle, is fitted in the bain marie.

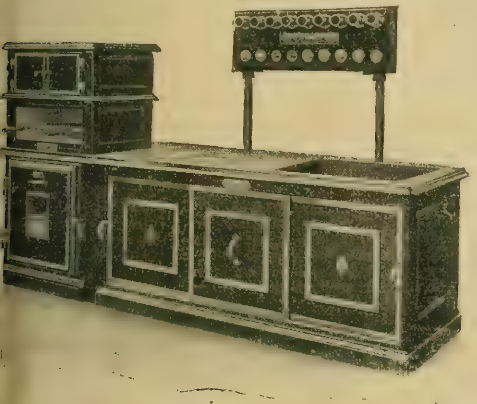

Fig. 5.—Carron Cooking Plant at the Engineers' Club.

The oven is a standard Carron model, having an available cooking space of 22 in. × 20 in. × 22 in., with top and bottom heating elements rated at 5 kw., each having heat regulation; the door carries a glass inspection window, thermometer, and ventilator. Over the oven is fitted a large griller and toaster, having a working area of 22½ in. × 16 in., and a height of 8 in. It is white porcelain enamelled throughout, and has a gravy collecting tray, brander, and grid, whilst the elements are rated at 6 kw., with sectional regulation. Above this is a small hot closet for the grill service; it has only two compartments, and is heated by separate heat from the grill only.

All the wiring is conducted to one switchboard, which, as will be seen, is carried on pillars at the back of the large hot closet, and on which are mounted the switches, fuses, and pilot lights.

The total loading of the equipment is 23 kw.; it is finished in bright black stove enamel, with raised parts, hob, and mouldings nickel-plated and polished.

The equipment has been in use for some months, and the chef is quite satisfied with its performance—as would be anticipated.

THE MECHANICAL DESIGN AND SPECIFICATION OF THE TURBO-ALTERNATOR ROTOR.

By S. F. Barclay, Ph.D., B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The objects of this paper are to review the conditions underlying the mechanical design of the high-speed alternator rotor, and to suggest a specification for the guidance of the purchaser's technical adviser.

Nothing has led to the development of electrical machinery from the mechanical point of view more than making alternators suitable for direct coupling to high-speed steam turbines. With the advent of peripheral speeds of over 4½ miles per minute the unsound construction of earlier times has disappeared, and the modern turbo-alternator rotor is not surpassed as a high-class engineering production. The need for the use of material of the highest grade is obvious when it is recalled that at the periphery of a 31-in. diameter rotor running at 3,000 R.P.M. a mass of 1 lb. exerts a centrifugal force of 2½ tons, and in the case of a 5,000-kw. alternator at 3,000 R.P.M. the total centrifugal force at the normal running speed is about 15,000 tons. The kinetic energy of such a rotor at the normal running speed is about 7,000 ft.-tons—equal to the muzzle energy of 23 75-mm. field guns, and sufficient to hurl 380 lb. of steel a distance of 6 miles. It is clear that eliminating weakness of construction by the lessons of failure is not a permissible policy with such machinery. The precise nature of the duty at the various parts of the rotor must be thoroughly investigated, the material employed must be of the highest grade, and the factor of safety must have a satisfactory value.

It is somewhat remarkable that the specifications drawn up by consulting engineers make little attempt to ensure mechanical excellence, although the electrical performance is usually very fully stipulated. But one never sees stipulated the all-essential permissible ratio between the stress and the quality of the material *in the direction of the stress.* An excessive overspeed test is undesirable, and does not necessarily establish mechanical soundness.

With the advent of large outputs at high speeds the salient-pole rotor has now disappeared. There still remains, however, some discussion as to the advantages of the solid as compared with the laminated rotor. In a normal turbo-alternator the output is limited by the rotor heating, and it is obviously a great advantage of the solid rotor that the ventilating channels can be arranged to secure the best cooling effect, whereas with the laminated rotor they have to be provided where mechanical considerations permit. The essential weakness of the laminated rotor is the presence of the central hole through which the shaft passes. With a 3,500-kw. alternator at 3,000 R.P.M. the maximum stress on the inner fibres exceeds the average stress by about 20 per cent. In addition to the stress caused by the centrifugal force, there is to be considered the stress due to the shrinkage fit of the stampings on the shaft; to ensure that the core shall remain tight on the shaft when running at the overspeed, the amount of the shrinkage must exceed the amount by which the core opens due to the centrifugal force. This requirement gives an appreciable increase to the stress in the core disks. Just at this part of the core disk where the stress is a maximum, the strength is very considerably reduced by the keyway cut into the lamination.

The solid rotor has the great advantage that the bursting stress is always less than the stress in the tooth, and the former stress has, therefore, never to be considered. Comparing the hoop stress for a laminated and a solid rotor for a 3,750-kw. alternator, even with a much deeper tooth the maximum stress in the forged rotor is only 13,800 lb., against 34,500 lb. in the laminations. Material for the core disks is prepared by rolling down hot slabs into sheets of the thickness required. No matter what care the manufacturer may exercise, some variations in the finished sheet are unavoidable. Minute local imperfections that would be without effect on a fairly thick plate may appreciably weaken a thin plate. Since material of this kind is inherently less dependable than a high-class forging, the factor of safety should be higher than with the solid rotor, but due to the weakening effect of the central hole the designer has to be content with a lower factor of safety.

To meet the demands of the electrical engineer for steel sheets having a high tensile strength, some manufacturers have taken advantage of the additional strength given by cold working. The effect of the cold working with large thin sheets is essentially somewhat uncertain, and such material cannot be regarded as being of a high grade.

With regard to the weakening effect of punching metal sheets, metal that was quite ductile before punching is found to be brittle round the punched edge. It is most important, therefore, that the core should be assembled in a jig and be bored out, since otherwise there would be brittleness and weakness at the part subjected to the greatest intensity of stress.

An entirely satisfactory high-tensile plate could be produced using nickel-chrome steel, but a rotor constructed with such plates would be more expensive than a solid forged carbon steel rotor, and would be less satisfactory mechanically and electrically.

Practically always, the running speed is above the first critical speed, and with large outputs at 3,000 R.P.M. the running speed may be above the second critical speed. For mechanical soundness it is deisrable to assemble the laminations under heavy end pressure. Under the combined action of vibration, stress, and pressure, the minute undulations in the laminations are removed, and in the course of time the end pressure, which might have been initially 200 tons, is found to have disappeared. With a newly constructed rotor the critical speed may have a satisfactory value, but after some running there may be a lowering of the critical speed and some vibration may result. The author has had experience of several cases of slight incurable vibration with laminated rotors that has developed after prolonged running, but in only one case was the vibration so bad that the rotor had to be reconstructed.

When high-grade forgings are available the solid forging is undoubtedly preferable for all sizes of rotors for polyphase work. For outputs in excess of 3,000 kw. at 3,000 R.P.M. the laminated construction should be employed only when it is impossible to obtain suitable forgings.

For large-diameter rotors at medium speeds thick plates are sometimes employed instead of laminations. This construction is preferable to using thin sheets, but the weakness of the centre hole and the high hoop stress, together with the unsuitability of using rolled plate with a pronounced fibre subjected to high stress in all directions, are still present, and when the critical speed is below the running speed, trouble with it is equally if not more pronounced.

Another alternative is the construction of using plates of considerable thickness held together with through bolts with a short shaft length at either end and no central hole. The great weakness of this construction is the difficulty of making the bolts satisfactory. The deflection is due almost entirely to the elongation of the bolts, the area of the plates being large compared with the area of the bolts and the compression of the plates therefore negligible. A very slight elongation of the bolts takes all compression off the plates, and consequently at the underside of the rotor the plates are out of contact. Each time the rotor turns round, stress in addition to the initial stress is thrown on the bolts. In the case of a 1,500-R.P.M. rotor this intermittent superimposed stress is applied and removed over two million times a day. It is claimed for the construction that the variation of stress can be maintained at so low a value that in spite of the rapid variation the duty is within the capacity of the steel. It is to be remembered, however, that the calculated stress may be considerably exceeded. With one case that came to the author's notice of a 6,000-KW. 1,500-R.P.M. alternator constructed in this way, it was found that after 2½ years' running some of the plates at the centre of the core had moved slightly out of centre. Where initially there had been a good fit, there was found to be a clearance on the spigot and in the bolt holes of 1/50 in.

Since the bolt area in tension is small compared with the rotor weight, the deflection in the body of the core is considerable and hence the critical speed is very low. Vibration is damped, and such a rotor has no real critical speed, but there may be sufficient vibration to be appreciable.

Such a construction can be seriously considered only with relatively large and relatively low-speed rotors, and is only to be employed when forgings are unobtainable.

The forged rotor having no central hole is very much stronger in its resistance to bursting than is the laminated rotor. It can be shown mathematically that a minutely small hole through the centre of a rotating cylinder doubles the stress. In addition to the gain due to the omission of the hole, there is the greater area of steel to carry the load, and altogether the bursting stress is so low that it has not to be considered.

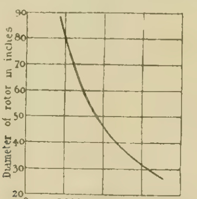

Fig. 1.—Relationship between Running Speed and Maximum Desirable Rotor Diameter.

The maximum stress with the solid forged rotor is always in the tooth, but the stress never reaches a high value, the maximum rotor diameter being determined by other considerations.

With the type of winding now in universal use, of concentric coils of flat copper strip, there is a fairly clearly defined limit to the rotor diameter that may be employed for a given speed. There are to be considered the stability of the end windings exterior to the core, the pressure on the insulation between turns, and the retention of the end windings against the action of centrifugal force. In the case of a 5,000-KW. alternator at 3,000 R.P.M. with a 31-in. diameter rotor, when running at the overspeed of 20 per cent. above normal, the average value of the maximum pressure on the insulation is about 5,000 lb. per sq. in. Pure hard mica is the only material that is really suitable for the purpose. The thickness of the insulation between turns of 0.01 in. cannot be exceeded without unduly adding to the size of the machine for a given output.

Under steady compression between flat surfaces mica can stand great loading before failing. In service, however, the conditions are not nearly so ideal There is always some degree of high-frequency vibration present, and the surface of the copper is never quite flat. For these reasons a big margin of safety is necessary.

Owing to the difficulty of retaining the rotor end-windings, the author believes that for a normal speed of 3,000 R.P.M a 32-in diameter rotor will come to be regarded as the maximum desirable size. The peripheral speed of such a rotor is 25 120 ft. per minute. In fig. 1 is shown the relationship between the angular speed and the maximum desirable rotor diameter.

The exciting energy required to drive the flux through the rotor may be of the order of 15 to 20 per cent. of the full-load excitation. It is important, therefore, that the permeability should be as high as possible consistent with satisfying the mechanical requirements. A carbon steel, containing about 0.35 per cent. carbon, after oil treatment has an ultimate strength of 38 tons per square inch, a yield point of 22 tons, an elongation of 22 per cent. on 2 in., and a contraction of area of 40 per cent. It is used for such purposes as railway exles, and is admirably suitable for alternator rotors. The permeability of this steel is quite good.

It is usual to express the factor of safety in terms of the ultimate strength—which is not quite logical, since it is the yield of the material that marks the limit of safety, and not the actual fracture. The author is of the opinion that the factor of safety should always be expressed in terms of the yield point, defined as being the stress at which there is a complete yield of the material that is observable to the eye. The maximum stress in the solid forged rotor is in the teeth. The stress is unidirectional and constant, and a factor of safety of 2 to 1 on the yield point is satisfactory. With this factor of safety the maximum permissible tooth stress with the quality of steel suggested is 11 tons per sq. in. With a well-proportioned rotor having a diameter of 31 in., the maximum tooth stress at 20 per cent. overspeed is about 9½ tons per sq. in. There must be some saturation in an alternator to give it magnetic stability. With a turbo-alternator the necessary saturation must be provided in the rotor teeth—that being the only part of the machine where a high density is permissible. On the other hand, if the saturation is carried too far, the loss in the teeth becomes excessive. In general, it will be found that with a stress of about 10 tons per sq. in. the corresponding tooth density is as high as it is desirable to employ, and the oil-hardened carbon steel therefore satisfies the electrical as well as the mechanical requirements.

If an alloy steel were employed with the object of being able to use a smaller tooth to give increased winding space, the increased magnetisation loss due, not only to the higher tooth density, but also to the lower permeability would more than offset the gain due to the increased copper space. An alloy steel for a large rotor forging is inherently not so reliable, there being a greater probability of internal flaws being present. A hole should always be bored through the forging when an alloy steel is used, to see that there are no internal flaws, and the effect of the hole is more than to double the hoop stress, so that the body of such a rotor actually would be weaker than if a carbon steel were used.

An interesting case came to the author's notice a few years ago of a rotor forging breaking just where the shaft merges into the body of the core. The steel used was 3½ per cent. nickel, having a yield point of 29 tons, and an ultimate strength of 46.5 tons per sq. in., and an elongation on 2 in. of 22 per cent. It was found that a huge internal cavity had been caused by the operation of forging. In another case a high carbon steel was employed having the composition of 0.61 carbon, 0.59 manganese, and 0.23 silicon, and the tensile properties of ultimate strength 49 tons per sq. in., yield point 22 tons to the sq. in., elongation on 2 in. 18 per cent., and reduction of area 32 per cent. After being in service for 3½ years the forging failed with a fatigue flaw in the neck of the journal. A micro-examination showed that the steel had not been properly heat treated, and had a large grain size. Such a steel, more particularly in the absence of correct heat treatment, is not at all suitable for a high-speed rotor.

The use of improper steels of this kind, and bad mechanical design, have led to a number of failures that have given rise to the feeling that the solid forged rotor is less reliable than the built-up design. There is no doubt that provided the right kind of steel is used, correctly forged and correctly heat treated, and that the mechanical design is sound, the solid forged rotor is by far the best construction, and the author has never heard of a single failure when these conditions have been observed.

(To be continued.)

Discussion in London.

Prof. A. B. Field said that the design of large rotors had now become a mechanical problem. Solid forgings were necessary with a speed of 3,000 R.P.M., and apparently the author chiefly had this speed in view when he wrote his paper. The author mentioned the great difficulty of making satisfactory bolts when plates of considerable thickness were used, and held together with through bolts, with a short length of shaft at either end, and no central hole. The statements made with regard to these bolts, he thought, were quite misleading, as the actual stress was 10 times larger than was stated. These stresses varied, but the speaker knew of large machines which had stood them satisfactorily for five years. He agreed with the author that when the plate construction was used the rotor had no critical speed. He had made a similar statement himself some time ago, at which he had arrived from a theoretical point of view. Referring to the quenching of steel, the speaker did not quite see how this could be done properly when large masses of 30 or 40 tons were handled. When speaking of the limit of forging size, the author seemed to be in doubt himself, and he thought it was preferable to bore a hole down the centre of large forgings. He endorsed the author's remarks on chrome-steel; this steel was most desirable in spite of its electrical faults, and should be used except in small machines, when other qualities became cheaper and were quite as good.

Considering the test pieces spoken of, he thought they should be taken from the centre of the ring. In the case of chrome-nickel steel, instead of one, two or three test pieces ought to be taken, and where large masses were concerned the test piece should come from the centre of the mass, and not from the outside edges.

Mr. F. H. Clough, in the main, agreed with the author, but several statements had been made from which he must differ. Apparently the author condemned all laminated rotors; he could not agree with this view, and he had never come across faults such as were mentioned by the author, even with the largest types of laminated rotors. The stresses involved came on and went off gently as the speed rose or fell, and it was, therefore, not essential to use material of high elongation. By using cold punchings he thought better ventilation could be obtained. With laminated rotors 60 per cent. better ventilation could be obtained than with the solid type. Referring to the question of critical speed, the speaker said that with speeds of 3,000 r.p.m. he had known machines which were perfectly safe. He did not think it was any longer possible to avoid critical speeds, and it did not, therefore, matter much when they occurred.

Dr. S. P. Smith congratulated the author on his paper, which, he said, could not have appeared at a better time. He said it ought to give confidence to some consulting engineers and nervous people generally, pointing out that it showed that British engineers and designers could hold their own in this respect. He had strong views on this subject, and said it would serve a better purpose if engineers inserted a clause in their specifications stating that machines must be built as well as designed by British engineers, instead of asking makers to point to similar or larger machines of their own make before they could take up the work, as some of them now did. He did not think the author had mentioned the fact that when plates were rolled cold there was a tendency for them to become thicker at the centre than at the edge. He was informed this was due to a fault of the rolling mill, and care must therefore be taken in building rotors to stagger these rotor plates, in order to guard against the rotors becoming longer at the centre than at the periphery. He had known a rotor to be 1 in. shorter at the periphery than at the centre due to this cause. Referring to short-circuit losses, he said that the heat generated on short-circuit was much greater than the same current and the same power factor (even at zero p.f.) would produce on load. This he attributed to the rotor ampere-turns being very great, they therefore caused saturation, and offered a bad path. He could trace no relation between loss on load and on short-circuit, and at the present time he thought the latter loss was put at much too high a figure. He thought the only way of getting at these losses was to make a heat balance, but it was possible they had no meaning at all.

Mr. A. R. Everest did not agree with the objects of the paper as set out by the author. He thought care must be taken not to standardise one maker's design to the exclusion of the designs of other makers or firms. He said the author's arguments in favour of the solid rotor were wrong, because he first said that rotors with a hole down the centre were weak, and, later, he advised that a shaft should be used for large machines because blades became weak. He thought that everything came back to the temperature of the rotor, and, therefore, to the ventilation. The rotor temperature was limited by the temperature of the windings which, in turn, was limited by the insulation specifications.

Mr. H. W. Taylor supported the author in his views, and he thought that the author's description of the lantern slides shown ought to be included in the paper. From the operating engineer's point of view some of them might begin to wonder how long it would be before their machines broke down. Until reading such a paper, some of them had no idea the steel used contained so many latent defects and weaknesses. Referring to ventilation, he thought it was absolutely necessary that all ventilating ducts should be easily accessible for cleaning purposes. With regard to the short-circuit heating, as it was so much greater than the same current produced when on load, he thought that if a short-circuit test was carried out and proved to be satisfactory they should then be quite satisfied that the machine was good for ordinary load conditions.

Dr. S. F. Barclay, in reply, said he agreed with Prof. Field's remarks up to a point. The whole point in connection with plates was the construction and reliability of the bolts. It was difficult to obtain a good fit, and unless the plates were well finished and a perfect fit they must be condemned. The question as to what was the largest mass of steel that could be worked had been in argument for some time, and there was certainly a difference between the centre and outside of such masses when the material was tested. He did not condemn laminated machines, as Mr. Clough suggested, until the larger sizes were reached, but the solid type was certainly preferable in most cases. With Mr. Clough's statement as to ventilation he could not agree. As to Dr. Smith's remark that plates were thicker at the centre, he had heard of this, but was not sure if it was inherent. All plates suffered in this way, and it was due to faulty machines when the plates were made. He thought consulting engineers in the past had gone too much into electrical detail, and they had neglected the mechanical construction. Having a hole through the centre of a laminated rotor certainly weakened it, but there was no objection to putting a hole through a solid rotor or cylinder on which no work had previously been done. There was no reason to say that laminated rotors could be better ventilated because the best place to put the ducts was immediately under the coils. There was very little dirt or dust deposited in the ventilating ducts themselves; it was all carried through into the end coils, and if these could be cleaned properly the ducts themselves did not matter very much.

Discussion at Leeds.

Mr. W. M. Selvey observed that Dr. Barclay's paper was one which they had been waiting for for quite a number of years. It was, he thought, the outcome of a paper delivered some years ago by Prof. A. B. Field. They had then criticised rather adversely the method of holding plates together by bolts in order to have the centre of the rotor unpierced by a hole. A little previous to that time they in England were not interested in making very large machines. The Americans were then a long way ahead of the British in that direction. With regard to flaws, they were given to understand in these matters that if they went to "the approved maker" they need have no misgiving with regard to internal flaws. They were up against two very big questions in modern rotors. The first was the difficult problem of supporting the end turns. The second was the question of cooling not the end turns, but the portion which passed through the slot. It had been his good fortune during the last two or three weeks to examine some four or five designs of 25,000 kw., and there were some striking differences in principle as to the way in which rotors were made. There was no particular feature of a rotor which had given more trouble to designers than the cylindrical part of the drum enclosing the end turns. Generally speaking, that had not been made of late in a solid piece, as Dr. Barclay mentioned. Almost invariably, except in low-speed rotors, that part ought to be made of magnetic steel, and it had been found most difficult to cool. It was inaccessible, and a place where dirt collected, and trouble had arisen through heating at the ends. The explanation put forward in connection with this heating at one time was that of unbalanced loads, but that had not always been borne out.

Mr. J. Shepherd (Leeds), dealing with ventilation, said that when very large units were used it would be necessary to abandon air cooling, and to adopt some form of liquid cooling.

Mr. Hefford (Leeds) said Dr. Barclay had not quite demonstrated to him the safety of making large rotors of one piece of steel. He did not see how they could deduce from microscopic examination the actual state of steel in the centre of a large rotor of 40 or 50 in. diameter. Dr. Barclay had remarked that an alternator with a solid rotor could quite well be designed to stand a short-circuit at the terminals without damage. He (Mr. Hefford) found that alternator builders were very chary of agreeing with this view, no matter what type of rotor was put forward. Dealing with plates, it was obvious there must be a high initial strain on plates when they were shrunk on the shaft, or else over-speed tests must tend to loosen them. Dr. Barclay had stated that an entirely satisfactory high tensile plate could be produced by using nickel-chrome steel. He, the speaker, had a rather large alternator going through his hands at the present time, and there had been great difficulty in producing a rotor for that machine. They tried several types of steel, eventually using rings shrunk on the shaft, and they had to obtain nickel-chrome steel before they could get the mechanical tests satisfactory. The speaker was not quite sure they were on right lines with regard to the ventilation of rotors by putting the fan on the rotor. By putting a fan in this position it created induced draught, or suction, where the shaft passed through the casing to the alternator. He had known cases where there were fans on either end of the rotor drawing air in and blowing it through the rotor and the stator, both at the same time, but he thought a fan for the rotor and another for the stator was preferable. One firm met the difficulty of cooling coils in the rotor by actually enclosing the winding in a thin metal case. He agreed with Dr. Barclay that an over-speed test of 20 per cent. was quite ample.

Mr. Wilson Hartnell (Leeds) said the paper was an instance of the direction in which engineering was tending, every part of the material used being carefully examined in a scientific manner.

Mr. Brown (Bradford) said this paper showed the necessity of thoroughly understanding the strength of materials. He noticed that under the heading of rotor windings, Dr. Barclay dealt with the question of insulation, and advocated mica. He would like to know whether Dr. Barclay advocated the use of mica for low-pressure machines up to 5,000 or 6,000 kw.

Dr. Barclay, in reply, said the laminated rotor did not apply only to small machines, as there were makers in this country building machines of 5,000 or 6,000 kw. on this principle, though, in general, laminations were only used for small machines. There was not much difficulty in cooling that part of the rotor coil that was buried in the core; it was the end turns that presented the difficulty. The problem was to get as much air through the rotor as they could. The fact that the coils were hotter at one end than the other did not matter if the hotter end was cool enough. Unbalanced load did not seem to have much effect in heating the end bells. Recently they had some cases of running with great unbalanced loads where no apparent heating was noticed. The whole difficulty of cleaning was that if they could get the holes in line they might clean the duct, but not the winding, and if dirt got caked into the winding it was impossible to get it out. There was no difficulty, if there was any object in doing so, in providing holes in the disk pieces. He fully agreed with Mr. Shepherd's remarks concerning the difficulties of ventilation when they came to the big sizes, but so far as 30,000 kw. was concerned there was no difficulty in getting the air through. He had seen machines of 5,000 kw. short-circuited many times, but nothing whatever happened. Mr. Hefford's remarks were very interesting concerning the construction of his big rotor, and one could appreciate the need for using nickel-chrome steel for the plates. The question of filters was a very important one. A leading firm of makers had told him recently that their filters would not eliminate greasy particles. No doubt the fault of most filters was that they let the grease pass into the machine. He had seen two machines of identical size running side by side; one had a filter, the other had not, and while the former was gummy and sticky, the latter was absolutely clear. No doubt filters did more harm than good if 95 per cent. of the dirt was removed while 5 per cent. was left to stick to the plates. In reply to Mr. Brown's question, he (Dr. Barclay) used mica, which in every case seemed to him to be the only reliable material.

AMERICAN EXPORTS OF ELECTRICAL GOODS.

The following figures, showing the exports of electrical goods from the United States during the year ended June, 1916, are taken from the recently-issued trade statistics; figures for 1914-15 have been added for purposes of comparison, and notes of any increases or decreases given:—

Telegraph instruments.—

	Dollars. 1914-15.	Dollars. 1915-16.		Dollars. Inc. or dec.
To Denmark	11,000	17,000	+	6,000
,, Canada	14,000	26,000	+	12,000
,, Central America	8,000	8,000		—
,, Mexico	17,000	41,000	+	24,000
,, Colombia	1,000	1,000		-
,, Argentina	—	2,000	+	2,000
,, Cuba	1,000	2,000	+	1,000
,, Brazil	1,000	1,000		—
,, Other countries	23,000	51,000*	+	28,000
Total	76,000	149,000	+	73,000

* Great Britain, $23,000; New Zealand, $6,000.

Telephone instruments.—

To United Kingdom	132,000	582,000	+	450,000
,, Canada	205,000	161,000	–	44,000
,, Central America	56,000	20,000	–	36,000
,, Mexico	8,000	20,000	+	12,000
,, Cuba	76,000	80,000	+	4,000
,, Brazil	51,000	48,000	–	3,000
,, Colombia	9,000	11,000	+	2,000
,, Ecuador	2,000	11,000	+	9,000
,, Japan	6,000	74,000	+	68,000
,, Australia	405,000	62,000	–	343,000
,, Other countries	199,000	260,000*	+	61,000
Total	1,149,000	1,329,000	+	180,000

* Italy, $137,000.

Other electrical instruments and appliances.—

To Canada	2,253,000	2,693,000	+	440,000
,, Mexico	244,000	314,000	+	70,000
,, Panama	300,000	212,000	–	88,000
,, Cuba	211,000	558,000	+	347,000
,, Argentina	191,000	412,000	+	221,000
,, Brazil	255,000	497,000	+	242,000
,, Japan	306,000	411,000	+	105,000
,, Philippine Islands	159,000	177,000	+	18,000
,, Australia	623,000	520,000	–	103,000
,, United Kingdom	1,950,000	3,490,000	+	1,540,000
,, Other countries	1,660,000	4,689,000*	+	3,029,000
Total	8,152,000	13,973,000	+	5,821,000

* France, $592,000; Italy, $910,000; Norway, $678,000; Russia, $452,000.

Gas engines, stationary.—

To [illegible]	83,000	58,000	–	25,000
,, Argentina	3,000	4,000	+	1,000
,, Australia	21,000	32,000	+	11,000
,, Europe	51,000	146,000	+	95,000
,, Other countries	262,000*	112,000	–	150,000
Total	420,000	352,000	–	68,000

* Russia-in-Asia, $197,000.

	Dollars. 1914-15.	Dollars. 1915-16.		Dollars. Inc. or dec.
Electric motors.—				
To United Kingdom	292,000	380,000	+	88,000
,, Canada	514,000	638,000	+	124,000
,, Panama	40,000	102,000	+	62,000
,, Mexico	81,000	49,000	–	32,000
,, Cuba	136,000	140,000	+	4,000
,, Argentina	30,000	54,000	+	24,000
,, Brazil	55,000	52,000	-	3,000
,, Chile	87,000	91,000	+	4,000
,, British India	83,000	69,000	–	14,000
,, Japan	303,000	139,000	–	164,000
,, Australia	634,000	686,000	+	52,000
,, South Africa	67,000	154,000	+	87,000
,, Russia-in-Europe	2,000	614,000	+	612,000
,, Italy	42,000	147,000	+	105,000
,, Other countries	453,000	904,000	+	451,000
Total	2,819,000	4,219,000	+	1,400,000

Steam engines, stationary.—

To Canada	103,000	142,000	+	39,000
,, Cuba	60,000	133,000	+	73,000
,, Mexico	8,000	17,000	+	9,000
,, Brazil	6,000	2,000	–	4,000
,, Philippine Islands		12,000	+	12,000
,, Other countries	121,000	106,000*	–	15,000
Total	298,000	412,000	+	114,000

* Venezuela, $18,000.

Electric locomotives.—

To Canada	110,000	72,000	–	38,000
,, Panama	158,000	—	–	158,000
,, Mexico	10,000	3,000	–	7,000
,, Bolivia	14,000	—	–	14,000
,, Chile	15,000	19,000	+	4,000
,, China	—	33,000	+	33,000
,, Brazil	—	12,000	+	12,000
,, Russia-in-Europe	—	146,000	+	146,000
,, Bermuda	—	96,000	+	96,000
,, Other countries	17,000	71,000	+	54,000
Total	324,000	452,000	+	128,000

Dynamos and generators.—

To Canada	246,000	330,000	+	84,000
,, United Kingdom	832,000	204,000	–	628,000
,, Panama	52,000	17,000	–	35,000
,, Mexico	36,000	9,000	–	27,000
,, Cuba	35,000	141,000	+	106,000
,, Brazil	3,000	4,000	+	1,000
,, Peru	35,000	8,000	–	27,000
,, Japan	301,000	88,000	–	213,000
,, Australia	76,000	24,000	–	52,000
,, Spain	—	34,000	+	34,000
,, Other countries	397,000	610,000	+	213,000
Total	2,013,000	1,469,000	–	544,000

Fans.—

To Canada	17,000	23,000	+	6,000
,, Argentina	18,000	63,000	+	45,000
,, Brazil	7,000	7,000		—
,, China	49,000	18,000	–	31,000
,, British India	44,000	92,000	+	48,000
,, Japan	19,000	11,000	–	8,000
,, Australia	12,000	21,000	+	9,000
,, United Kingdom	30,000	20,000	–	10,000
,, Other countries	62,000	102,000	+	40,000
Total	258,000	357,000	+	99,000

Arc lamps.—

To Canada	10,000	8,000	–	2,000
,, Brazil	2,000	2,000		—
,, Other countries	19,000*	9,000	–	10,000
Total	31,000	19,000	–	12,000

* United Kingdom, $10,000.

Metal filament lamps.—

To Russia-in-Europe	6,000	115,000	+	109,000
,, Russia-in-Asia	26,000	9,000	–	17,000
,, United Kingdom	35,000	87,000	+	52,000
,, Canada	62,000	135,000	+	73,000
,, Mexico	20,000	86,000	+	66,000
,, Cuba	74,000	172,000	+	98,000
,, Argentina	[illegible]	82,000	+	[illegible]
,, Brazil	39,000	101,000	+	62,000
,, Australia	25,000	92,000	+	67,000
,, Other countries	155,000*	403,000†	+	248,000
Total	473,000	1,282,000	+	809,000

* Italy, France, and Spain, $10,000 each.

† South Africa, $57,000; India, $21,000; China, $67,000.

Carbon filament lamps.—	Dollars. 1914-15.	Dollars. 1915-16.	Dollars. Inc. or dec.
To Argentina	8,000	11,000	+ 3,000
,, Canada	11,000	18,000	+ 7,000
,, Mexico	23,000	14,000	– 9,000
,, Brazil	5,000	7,000	+ 2,000
,, Other countries ...	55,000*	95,000†	– 40,000
Total	102,000	145,000	+ 43,000

* United Kingdom, $10,000.

† Russia-in-Europe, $18,000; Australia, $6,000.

Insulated wire and cables.—			
To France	150,000	150,000	—
,, Norway	129,000	318,000	+ 189,000
,, United Kingdom ...	272,000	663,000	+ 391,000
,, Spain	36,000	87,000	+ 51,000
,, Canada	137,000	148,000	+ 11,000
,, Panama	195,000	236,000	+ 41,000
,, Mexico	42,000	58,000	+ 16,000
,, Cuba	166,000	281,000	+ 115,000
,, Brazil	143,000	286,000	+ 143,000
,, Australia	64,000	66,000	+ 2,000
,, Other countries ...	578,000	864,000	+ 286,000
Total	1,912,000	3,157,000	+ 1,245,000

Static transformers.—			
To United Kingdom ...	37,000	44,000	+ 7,000
,, Spain	1,000	133,000	+ 132,000
,, Canada	73,000	132,000	+ 59,000
,, Panama	19,000	50,000	+ 31,000
,, Mexico	32,000	17,000	– 15,000
,, Cuba	46,000	32,000	– 14,000
,, Brazil	36,000	94,000	+ 58,000
,, Chile	10,000	17,000	+ 7,000
,, Japan	1,000	4,000	+ 3,000
,, Australia	54,000	70,000	+ 16,000
,, Italy	37,000	84,000	+ 47,000
,, Other countries ...	278,000*	316,000†	+ 38,000
Total	624,000	993,000	+ 369,000

* India, $99,000. † South Africa, $60,000.

REVIEWS.

Steam Turbines. By James Ambrose Moyer, S.B., A.M. Third Edition, revised and enlarged. London: Chapman and Hall, Ltd. Price 16s. 6d. net. Pp. ix + 468.

That the present book, which was first published in 1908, should have reached its third edition, bears witness to its usefulness to a section at least of that large number of engineers now interested in the steam turbine. The first edition, appearing when treatises on the turbine were fewer, was noticeable among its competitors by reason of the practical manner in which certain problems of design were approached, and it was therefore a really useful book to those who sought working rules for design rather than the generalities and mathematical disquisitions which formed the bulk of the earlier turbine literature. The present addition retains these points of value, but one is disappointed to find by no means so great an advance along the same lines as might reasonably have been hoped for. The treatise is, in fact, worth a far more drastic revision and development than it has received.

The contents of the work fall naturally into two parts, certain chapters and sections being devoted to the calculations necessary in design, and the remainder being more or less of a general descriptive nature. The former part alone justifies the inclusion of the book in a draughtsman's library. After a few introductory pages the reader is taken through the elementary theory of heat and the use of the entropy chart in a manner well suited to the needs of the average draughtsman, and always with a view to the practical application of the principles to the behaviour of steam in a turbine. The treatment of the subject is good, and should rob the name of entropy of its terrors to the uninitiated, for by means of the Mollier diagram—of which the one issued with the book is the best we have seen—all computations concerning the adiabatic expansion of steam are brought within the scope of the least mathematical of designers. The chapter contains, however, one blunder which should never have been permitted in a third edition. On page 16 the author, in dealing with the available work in a pound of steam, as illustrated by the P.V. diagram, falls into grievous error in treating the area under the curve before expansion as negligible to turbine designers. A little arithmetic will show that it is by no means negligible, for with steam at 165 lb. absolute pressure, superheated 100 deg. Fahr., and expanding down to a 28-in. vacuum, the available energy represented by the despised area is more than 97 B.TH.U. per lb., or nearly 30 per cent. of the total available energy.

The next chapter deals with the design of nozzles and, like the former one, is clear and practical in its treatment of the subject, so that the student can see exactly how the correct proportions of a nozzle can be obtained for any condition of working. It might, however, have been more enlightening to such readers to have calculated the flow through the throat of an expanding nozzle from the heat drop between the initial and the critical pressure, thus avoiding Grashof's formula, and bringing the calculation into line with that used for determining the outlet conditions. Considerable space is next devoted to the design and lay-out of blading, both for impulse and reaction machines, but, as in the case of the nozzles, the practical problems of manufacturing and fixing them are hardly referred to. In discussing the calculations for the design of reaction turbines, Mr. H. M. Martin's well-known treatise on the steam turbine is largely drawn upon.

The various sources of loss in steam turbines are given a chapter to themselves, but this comprises a few pages only, and is practically confined to a discussion of disk and blade rotation losses. Dummy leakage is, however, dealt with in another connection elsewhere in the book. Another short chapter on methods of correcting steam turbine tests for different steam conditions explains merely the method of applying the manufacturer's correction curves and data, and, curiously enough, does not even mention the easy and simple method of making comparison between turbines on the basis of their respective efficiency ratio.

The longest chapter in the book, comprising nearly one-fifth of the whole work, deals with "Commercial Types of Steam Turbines." It can hardly be given a word of commendation. The matter is too badly selected, badly arranged, and too much out of date to give anything like a fair idea of modern turbine practice. The de Laval turbine is given 19 pages. The Parsons type, which, we read with astonishment, "differs from that commonly known as de Laval principally in the substitution of stationary blades in the place of nozzles," occupies 25 pages, and illustrates nothing but the practice of the Westinghouse and Allis-Chalmers companies. The Fullagar method of balancing, first introduced by Messrs. Willans & Robinson, is credited to the Allis-Chalmers Co., although in a full-page sectional drawing of a turbine by the latter company the ordinary system of dummies is illustrated. The method of shrouding blades first adopted by Messrs. Willans is described in connection with the Allis-Chalmers machine, and the Westinghouse method of lacing blades is also described, but there is not a word about the rosary system of blading or the practice of thinning the blade tips, both of outstanding importance in reaction turbine practice.

The Curtis turbine is given 14 pages, and from these one would gather that the old vertical type was still characteristic of this make. The treatment of the Rateau turbine is still more unfortunate. The old dished wheels, with stamped sheet-iron blades riveted to the rims, are illustrated and described as exemplifying current practice, although they have been abandoned for years. After stating that the Rateau turbine possesses from 20 to 40 stages, the author illustrates one with seven stages only. The Zoelly turbine gets only a page and a half of descriptive matter, with no illustrations. The remainder of this thoroughly unsatisfactory portion of the book deals with the Hamilton-Holzwarth and the Wilkinson (Rateau) types, and also describes a few small machines such as the Sturtevant, Kerr, Terry, Dake, &c. The Ljungström turbine, with its extraordinary efficiency and great mechanical interest, is never even mentioned, either in this chapter or elsewhere.

Mixed-pressure turbines and low-pressure turbines to work in conjunction with reciprocating engines form the subjects of two descriptive chapters, and marine turbines are disposed of in a single chapter of seven pages, of which half a page only is given to the possibilities of electrical transmission. The rest of the chapter deals principally with the possibilities of the Westinghouse-McAlpine gear, and of the combination of reciprocating engines and turbines for ship propulsion. It contains no suggestion of knowledge that the latter combination is in actual use, nor that Sir C. A. Parsons's geared turbines have been driving ships for several years.

The chapters on "Tests of Steam Turbines" and "Steam Turbine Economics" call for little comment. In the first, numerous test results are given, but many are quite out of date, and none is later than 1911. After these we come upon a chapter which is quite useful to the designer, giving, as it does, practical methods of calculating the approximate stresses in drums, disks, and rings. The mathematics here, as elsewhere in the book, are well within the average draughtsman's reach, and practical examples are worked out.

The gas turbine is given a chapter to itself, containing views and photographs of some of the few machines which have been designed or constructed, and indicating generally the calculations appropriate to the subject. The author appears to have some hope that in the future a practical gas-turbine may be evolved. He is, however, under no illusions as to the mechanical difficulties incidental to the temperatures employed, and touches, though perhaps too lightly, upon what appears to be the first problem to be solved, namely, the production of an efficient rotary compressor. To get any reasonable efficiency the gas must be compressed before combustion, and until a rotary compressor of at least 80 per cent. efficiency can be constructed, there can never be a commercial gas turbine, however well the temperature difficulties may be surmounted.

Turbo-generators form the subject of the last chapter in the book, and are disposed of in four and a half pages. As may be gathered, the treatment is of the most general kind, and little else is attempted beyond pointing out the limitations encountered when endeavouring to construct generators for high rotational speeds.

Mechanical Handling of Material and its National Importance During and After War. By George Frederick Zimmer, A.M.Inst.C.E. London: Crosby Lockwood & Son. Price 10s. 6d. net. Pp. 140, 144 figs. (10 col. plates.)

This book may be termed a supplementary volume of the author's well-known book, "The Mechanical Handling and Storage of Material," and deals in a concise way with the various types of labour-saving appliances, describing also the improvements that have been introduced since the publication of the larger work.

The subject is of great importance even in peace-time, but vastly more so now that we are in the midst of a dreadful war, and the demand for labour-saving appliances has become so pressing. It will be so even after the war, when the terrible great work of reconstruction begins to repair the terrible ravages of war. We are told that in ordinary times an employer is justified in expending £1,000 capital to save the labour of one man, but after the war there will be such a scarcity of labour that there is every probability that even if twice this amount be required for the machinery to be installed, it will prove to be quite a good investment. In the author's opinion, however, "in practice, if driving power, supervision, lubrication, interest on capital outlay, depreciation, and repairs are taken into account, an outlay of approximately £750 per man replaced appears to be well within the province of a commercial transaction; but there is not even the necessity for such a capital outlay to save the labour of one man, as such an amount spent is more likely to release five or six labourers."

Practical examples of the various systems of handling material by conveyors, hoists, pneumatic handling, mono-rails, and telpherage are given, in many cases with notes of the cost and saving to be effected. A good part of the work deals with the equipment of gas works, boiler houses, storage of coal, floating loading devices, and bunkering at sea. The subject is, of course, enormous in its range, and the author has done his best to cover practically instances of labour-saving appliances applicable to every industry. The only one that appears to be neglected, but one which is of vital importance at the present time, is labour-saving machinery appertaining to agriculture. The section dealing with portable loading and unloading devices, however, may be read with advantage even by the farmer.

It is a book which at the present time should be carefully studied by the management of every industry, and if there is any means by which labour may be saved the plant or machinery should be installed with the least possible delay; for every penny so invested, pounds will be returned in the years to come.

Telegraph Practice. By John Lee, M.A., Postmaster of Belfast, and late Deputy Chief Inspector of Telegraph and Telephone Traffic, G.P.O., London. Longmans, Green and Co. 2s. 6d. net. Pp. x + 102.

In this small volume of 100 pages Mr. Lee outlines the telegraph practice of this country as it is to-day, and contrasts it with the methods of other administrations.

Coming from one who has in no small measure been identified with the recent developments on the traffic side of telegraphy and telephony, the book may be taken as an authoritative review, not only of the considerations which have determined departmental policy in the past, but also of the probable lines along which that policy may be expected to develop in the future.

In 10 chapters the author deals with such aspects of the subject as the acceptance of telegrams from the public, the centralisation of traffic, instrument rooms, instruments, delivery of telegrams, Press telegrams, tariffs, and the future of telegraph practice.

To-day, when the Baudot system bulks so largely in British telegraph practice, it is amusing to recall Mr. (afterwards Sir) W. H. Preece's assurance in 1882 that this system was not a successful one, and that the "game was not worth the candle"!

Our great underground telegraph system of to-day was likewise regarded by the same high authority then as impracticable, chiefly because it would cost £20,000,000. Let us hope Mr. Lee's anticipations will not suffer a similar fate.

The book, which is packed full of information, is clearly and tersely written, and will, we are sure, be read with much interest not only by those immediately concerned in telegraphic developments, but by that larger number who like to keep themselves *au courant* with national progress generally.—A. F.

NOTES ON THE MINERAL OUTPUT OF GREAT BRITAIN.

The report of H.M. Chief Inspector of Mines for the year 1916 has just recently been issued. This report summarises all particulars from the six inspection districts comprising Great Britain. It takes the place of the separate reports which each District Inspector usually sent in, and therefore is very considerably curtailed.

For the year 1916 we learn that the output of coal was 256,375,366 tons, which is an increase of 3,169,285 tons over the year 1915. The value of the output was £200,014,626, being no less than £42,183,956 greater than for the preceding year. This is due not only to the increased output, but also to the higher selling price, the average for 1915 being 12s. 5·6d., whereas in 1916 the price was 15s. 7·24d. per ton.

The total value of all the minerals raised in this country in 1916 was £214,034,524, being an increase of £43,576,266 over the year 1915. From this it is interesting to note how great and valuable an asset the country has in its coal fields, and how necessary it is to conserve them as much as possible.

The quantity of coal exported was 55,001,113, as against 59,951,925 tons in 1915. The amount of coal remaining for home consumption, therefore, was 201,374,253 tons, or 4·525 tons per head of the population. Of this, however, 39,384,879 tons was used in the manufacture of gas coke and briquettes, and 19,780,690 tons in the manufacture of pig iron, as against 37,173,489 tons, and 18,754,028 tons respectively in the previous year. Summarising the foregoing, we have :—

Coal exported	55,001,113	tons.
Used for gas coke and briquettes ...	39,384,879	,,
Used in the manufacture of pig-iron	19,780,690	,,
Domestic purposes	142,208,684	,,
Total output	256,375,366	tons.

The quantity of anthracite (included in the foregoing totals), raised mostly in the South Wales coalfield, was 4,644,045 tons, the value of which was £4,159,953. Outside the steam coal collieries the price varied from 13s. to 16s., while the steam coal obtained from 16s. to 19s. per ton. The other principal minerals of value are :—

	Tons.	Value.
Chalk	12,786,321	£145,504
Clay and shale	6,500,388	1,247,338
Gold ore	1,338	650
Copper ore	787	6,234
Iron ore	13,494,658	5,545,072
Lead ore	17,107	339,169
Limestone	11,115,909	1,395,830
Oil shale	3,009,232	1,032,294
Salt	1,960,448	901,133
Tin ore	7,892	712,142
Tungsten ores	394	49,699
Uranium ore	51	1,001
Zinc ore	8,476	65,304

Of these some show an increase in output over the previous year, whilst others show a decline. Iron ore, for instance, is less by nearly 800,000 tons, copper is increased by over 200 tons, gold ore is reduced by nearly 400 tons, zinc ore is also reduced by nearly a like amount, whilst tungsten is slightly increased. With the rare metals, however, this is more probably due to natural causes than to any effect in working the deposits due to the war.

The following table is also of interest, inasmuch as it gives the quantity and value of the metals obtained by smelting from the ores given above :—

Antimony ...	4 tons	£340
Copper	278 tons	37,794
Gold (bar) ...	273 oz.	884
Iron	4,319,096 tons	35,045,211
Lead	12,573 tons	389,449
Silver	86,485 oz.	11,284
Tin	4,697 tons	855,656
Zinc	3,000 tons	205,350

The total value was £36,545,968, an increase of nearly £9,000,000 over the year 1915.

With regard to the number of persons employed in the mines of the United Kingdom, there was an increase of 44,045 persons over the year 1915, the total in 1916 being 1,017,518. Of these 804, 69 persons were employed underground and 212,749 above ground. Of the latter 9,947 were females, being an increase of 2,286 females. On the other hand, in the metalliferous mines and quarries there was a decrease in the number of persons employed to the extent of 13,931, the total number being 48,196.

The output per person employed in coal mines, which is approximately 252 tons per annum, is, we regret to say, still very low, and unless there is a distinct improvement in this direction, we may not look to the coal trade of this country for any material help in restoring the national prosperity at the end of the war. We fear that Bolshevism amongst the miners is a factor which will have to be dealt with sooner or later if this country is to maintain its high position amongst the nations of the world.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

"Prof. Perry's" (?) Harmonic Analysis.

When an English student has made and explained a useful discovery, he seldom gets anything more than the honour of having done so, and one, therefore, cannot too strongly denounce a conspiracy to rob him of this, such as now appears to exist in the case of Mr. Wedmore and his method of harmonic analysis.

This method is explained in the *Proceedings* of the Institution of Electrical Engineers for 1896; and as Prof. Perry had previously invented a method of effecting the same object, he can be excused for not at first having fully recognised the superiority of the new method. But he cannot be excused for having eventually adopted this method in a way that makes it appear to be his own. I have before me a work on "Practical Mathematics," by Usherwood and Trimble, published by Macmillan in 1916, with a section devoted to the explanation of Mr. Wedmore's method, but it is headed "Perry's Tabular Method," and there is no mention whatever of Mr. Wedmore. Mr. Trimble may be genuinely under the impression that the method really is Prof. Perry's; anyone might think so from the way in which Prof. Perry is now teaching it. But I regret to say that this cannot be the case with Mr. Usherwood, for I have now seen a pamphlet written by him, and published by the Board of Education in 1912, which shows that he even then knew this was "Wedmore's method."

Messrs. Macmillan refuse to discuss the matter, and it therefore appears that a great injustice is going to be done to Mr. Wedmore unless some fair-minded editor of a widely-read journal will allow the matter to be dealt with in his columns.

W. F. Dunton.

Newcastle-on-Tyne, *March 23rd*, 1918.

Nomenclature.

After reading Mr. A. P. Trotter's article, I would like to relate my experience in support of "Direct Current." In deciding the nomenclature applied to things in general, one often follows the lead until such time as experience defines more particularly an apt application which may differ from custom.

A case in point occurred with me a few years ago. In regard to electrical matters it had been my custom to follow the diction of Dr. Silvanus P. Thompson at Finsbury, and style the distinctive currents as alternating current and continuous current. I was quite happy in the use of the term continuous current for a number of years, but received a distinct awakening when in competition with an alternating-current man. It will be remembered I was consulting engineer to the Stourbridge Council, and designed the power station and a continuous-current supply system for the town.

During negotiations between the Midland Electric Corporation and the Council, Mr. Hardie McLean very ably informed the Council that if the choice was for continuous current, his company could undertake to give *a continuous supply* for 24 hours per day. Needless to say, the M.E.C. is alternating; so that since that meeting I have preferred to use the prefixes alternating and direct, as either, in public supply, is continuous.

J. B. Clarke, A.M.I.E.E.

Handsworth, *March 23rd*, 1918.

The C.T.A.A. and the E.P.E.A.

In your issue of 21st inst., it is reported that "an application" has been made by the C.T.A.A. to the E.P.E.A. for affiliation. As a member of the former Association, I would point out that the statement is incorrect.

What actually happened was that some members of the C.T.A.A. discussed the matter with members of the E.P.E.A., and it was mutually agreed that as the two Associations had some objects in common, expense and time would be saved if each Association confined its activities to the grades of officers it originally set out to organise, instead of both associations covering the same ground. This, it will be agreed, showed reasonableness on the part of the C.T.A.A., and the majority of the members of the E.P.E.A. with whom the matter was discussed were equally reasonable.

It now, however, appears that there are other interests in the E.P.E.A., which have resulted in the unreasonable attitude adopted, and which should be suppressed if we are to achieve what both associations are setting out for, viz., the formation of a comprehensive association for the protection of the interests of the whole of the electricity supply engineers in the United Kingdom.

H. F. J. Thompson,
Chairman.
Chief Technical Assistants' Association.

Electricity Works, Battersea, *March 22nd*, 1918.

National Electricity Supply.

May I draw your attention to one error in your otherwise excellent abstract of the remarks that I made at the Engineers' Club, Manchester, on the electric power supply of Great Britain.

I am reported to have said that "it was essential that they should have the same type of Board for every district." As a matter of fact, I expressed an entirely opposite opinion, as the subsequent text shows.

S. L. Pearce,
Chief Engineer and Manager.

Electricity Works, Manchester, *March 23rd*, 1918.

WAR ITEMS.

Exports to China.—The "London Gazette" for March 22nd contains a further list of bodies to whom exports to China may be consigned.

Trading with the Enemy.—The "London Gazette" for March 22nd contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Paraguay, Bolivia, Brazil, Chile, Santo Domingo, and Peru.

The Genoa Treason Charge.—The "Times" correspondent at Milan stated that the trial was to begin in Genoa on March 20th of seven Germans and several Italians on a charge of treason in connection with the Genoa Electric Light Works. This company, it is asserted, was used by Germany for many years for purposes of espionage.

Exemption Applications.—At Southport, a motorman on the Birkdale tramways, aged 38, and in Grade 3, was refused exemption, and directed to report for service by April 14th; and an electric car driver, with the Southport Corporation (18, Grade 1) was directed to join up by April 7th.

At Winchester, the National Service Representative appealed against exemption held by a meter tester and a stoker at the Corporation electricity works. In the former case it was contended that the man was not employed in generating electricity, but a representative from the department said that it would not be possible to maintain the supply of current in the city if the man was taken. It transpired that he was in Grade 3, and, as the case was not pressed, the Tribunal dismissed the appeal, holding that the man was in a certified occupation. In the case of the stoker (Class A), the Military contended that the case was one for substitution by the employers. On the other hand, it was urged that the occupation of a stoker was a skilled one, as it involved the management of the boilers, the man being responsible for the maintenance of the head of steam. It was added that there were three stokers at the works, each working an eight-hour shift. This appeal was also disallowed on the ground that the man is in a certified occupation.

At Maidstone, on March 18th, appeals were filed for the retention of W. H. Brown (38) and E. Wicks (28), engaged by Mr. Oswald Jones, electrical engineer. It transpired that both men had received protection cards, and no action was consequently taken.

At Worcester Tribunal, Lieutenant C. E. Abell, electrical engineer, Worcester, asked for the renewal of the certificate granted to W. Tetstall (42), who is carrying on the business whilst the employer is in the Army. It was stated that the man was doing important work, including the supervision of seven rifle-range telephones. The certificate was renewed until June 30th.

At Reigate, exemption was claimed for L. L. Cochrane (35), electrical engineer at Netherne Asylum. It was stated that he helped to carry out the installation, and that he knew the whole of the wiring at the asylum. Temporary exemption until June 15th was granted.

At Oxford, the Electric Tramways Co. appealed for further exemption for T. Smalley (33, B 1) and V. Hill (36, B 1), foremen drivers. The general manager, Mr. A. A. Tyler, said that they had been unable to replace the men, and women were unsuitable for the work. Each was given two months' temporary exemption.

BUSINESS NOTES.

Dick, Kerr Developments.—As our readers are already aware, Messrs. Dick, Kerr & Co., Ltd., who many years ago established a world-wide reputation as contractors for tramway, railway and other big public works, and followed on with the manufacture of electrical machinery at Preston, made arrangements a few months ago for the acquisition of the United Electric Car Co., Ltd., Preston, where railway and tramway rolling-stock had long been a speciality. They had also acquired control of the business of Willans & Robinson, Ltd., of Rugby, the well-known builders of engines, turbines and Diesel engines. The foregoing businesses, while retaining their separate identities, are concentrated for sales purposes, as already explained, in the hands of Messrs. Dick, Kerr and Co., Ltd., whose headquarters are at Abchurch Yard, Cannon Street, E.C. We now learn that within the last few weeks negotiations have been completed with the Phœnix Dynamo Manufacturing Co., Ltd., of Bradford, by which certain standard types of electrical machinery, which have been manufactured separately by both companies, will be manufactured jointly at Bradford. The advantages accruing from such arrangements, especially from the combination of the technical and manufacturing experience of the various firms which they thus ensure, though each of the works will confine itself to those products for which it is best equipped, hardly need pointing out. Under the centralised direction of the D.K. organisation, with its extensive Home and foreign connections at the service of the associated companies, the combination should find itself well prepared to meet after-war competition.

Lists.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—Net price booklet relating to taped and braided wires and cables, and the Henley wiring system. This is the third edition. Copies will be sent to any *bonâ fide* buyer who has not already received one.

Messrs. Belling & Co., Edmonton, London, N. 18.—Illustrated circular giving a few particulars of their electric roasting and baking ovens for communal kitchens.

Liquidations.—Monometer Manufacturing Co., Ltd.—This company is winding up voluntarily. See this column last week.

Galway and Salthill Tramway Co.—Mr. M. Crowley has been appointed by the Courts official liquidator for winding up this company.

For Sale.—Middleton Corporation Electricity Department invites offer for surplus electrical plant consisting of steam dynamos, boilers, and accumulators. Particulars are given in our advertisement pages to-day.

Trade Announcements.—Owing to the Government having taken possession of their offices at the White Mansion, York Street, Westminster, Messrs. J. B. Saunders & Co., Ltd., have removed (as from 28th inst.) to Cromwell House, 6-9, Surrey Street, Strand, W C. 2.

Messrs. Handley & Robinson, Ltd., electrical contractors, who are moving from Great Charles Street to 165, Edmund Street, Birmingham, desire to receive catalogues and price lists from manufacturers of electrical goods.

Bankruptcy Proceedings.—G. E. Hipkins, electrical engineer, Bath Street, Dudley.—Supplemental dividend of 5s. 1½d. in the £, payable March 25th, at Official Receiver's office, 1, Priory Street, Dudley.

No Dry Batteries from Norway.—The Norwegian Government has prohibited the exportation of dry batteries of all kinds during the war.

LIGHTING AND POWER NOTES.

Aylesbury.—Price Increase.—The T.C. has revised the tariff as under :—Private dwellings, for lighting, 7d. and 1½d. per unit : shops, for lighting, 4d. per unit ; power, 3d. for the first 250 units per quarter, decreasing on a sliding scale to 1½d. for all above 2,250. For the summer quarters the minimum is fixed at 6s., and for the winter quarters at 10s.

Bridlington.—At a recent meeting of the T.C. reference was made to a scheme for the development of a considerable portion of the East Riding district. If carried out, it would open out the important agricultural district across the Wolds, extending approximately from Flambro' to Frodingham Canal, in the direction of Hornsea. Electrical energy would be generated at Bridlington, and transmitted through the district, supplying farms and villages with electricity for power and other purposes. It is estimated that the scheme would involve an expenditure of £250,000.—*Sheffield Independent.*

Brighouse.—Wages.—In response to the Corporation workers' demand, through the Workers' Union, for £1 per week advance on pre-war wages, plus 12½ per cent. bonus on total earnings, the Committee on Production has awarded, as from the first pay day in January, 1918, 8d. per shift advance to shift workers over 18 years of age, and 4s. per ordinary week to other workers. The previous increases have been 12s. to 16s. per week. There is no mention in the award of the 12½ per cent. bonus.

China.—H.M. Consul-General reports in the *B. of T. Journal* that there is a very promising business to be done in irrigation plant in Yunnan, where there are prospects of a great future for British trade. At present, within a few hours' journey of the city of Yunnanfu, there are in operation four irrigation sets owned by a private company. It would be comparatively easy to install a hundred such sets if the business were followed up and cared for, as there are immense tracts of land within easy reach of water, but at an elevation of some 15 ft. above the water level. When the owners can be made to see that the installation of pumping sets is advantageous, and that water can readily be lifted and supplied to the fields at very cheap rates, business will go ahead. It is very important that the farmers should be favourably impressed, and the machinery, therefore, should be of first-class workmanship ; the makers should supervise the installation and attend to the many details that tend to make a plant like this a success.

Clayton.—Prov. Order.—The Electrical Distribution of Yorkshire, Ltd., has intimated its intention of withdrawing its application for a provisional order for supplying electricity to Clayton.

Frinton-on-Sea.—Price Increase.—The E.L. Co. has informed the U.D.C. that it intends applying to the B. of T. for sanction to raise the maximum charge for energy from 7d. to 9d. per unit. The Council has decided to ask the B. of T. to limit the increase to the period of the war, and for not more than six months afterwards.

Huddersfield.—Rates Relief.—At a meeting of the T.C., last week, when rating was considered, it was stated by Alderman Woodhead (chairman of the Finance Committee) that notwithstanding the heavy cost of repairs and of war bonuses, the Tramways Committee could afford to grant 3d. in relief of the rates (as compared with 4d. last year) and the Electricity Committee would give 1d. in the £ in relief.

Hull.—The Corporation Electricity Committee has appointed the chairman (Councillor Pybus) and the acting electrical engineer (Mr. Magoris) to interview the Ministry of Munitions with respect to the difficulty of efficiently maintaining the generating station owing to the calling-up of employés. It was reported at the last meeting that the last of the switchboard attendants and a charge engineer had been called up.

London.—Hampstead.—Price Increase.—The Lighting Committee has considered the question of the estimated deficiency of £3.970 at March 31st, 1919, and recommends that the war charge should be increased as from the readings of the meters in September next from 33⅓ per cent. to 50 per cent.

St. Pancras.—Rate Relief.—The Finance Committee reports that a balance of £6,114 remains after the retention of £4.000 as a working balance, to the credit of the electricity revenue account to March 31st, 1917, and recommends that £6,000 should be allocated to the relief of rates.

Stepney.—The General Purposes Committee reports for the information of the Council that the Electricity Supply Committee has informed it that the extension of the expression "munition work" in the Munitions of War Act, 1915, by the Munitions of War (Amendment) Act, 1916, covers the electricity supply undertaking, whilst Sec. 12 of the last-mentioned enactment explains the term "workman" and "workmen" wherever they occur in both enactments as including "not only persons whose usual occupation consists in manual labour, but also foremen, clerks, typists, draughtsmen, and other persons whose usual occupations consist wholly or mainly in work other than manual labour" ; and that the officials of the undertaking, including the electrical engineer and manager, are, therefore, automatically entitled to, and consequently participate with the technical staff and other employés in, the benefits of the awards of the Committee on Production and receive a war wage advance of £1 per week on pre-war rates, in addition to an amount equivalent to 12½ per cent. on their total earnings, including such advance.

Manchester.—Fire.—A serious fire at the sub-station of the British Carbide Factories, Ltd., Clayton, which is supplied with electricity from the Stuart Street generating station, involved the whole of the company's electrical apparatus. A severe short circuit reduced the high-tension voltage to such an extent as to throw out of action practically all the plant in the sub-stations supplying the tramways. Some portions of the general system were not affected. There was no accident at Stuart Street, and no damage to the plant installed there.

Oakengates.—Power Bill.—The U.D.C. has decided to oppose the Bill of the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Oxford.—Price Increase.—The Oxford Electric Co., Ltd., has revised the prices of energy as under after the reading of the meters for the March quarter:—Lighting, up to 20 units per quarter, a minimum of 13s. 4d.; for the next 180 units, 5½d. per unit; the next 500, 5d.; the next 1,000, 4½d.; the next 3,000, 3½d.; beyond, 2½d. Heating and cooking, 1½d. Motive power, up to 2,000 units per quarter, 1¾d.; the next 3,000, 1½d.; the next 5,000, 1¼d.; beyond, 1d. These rates, except the statutory rate of 13s. 4d., are subject to a temporary increase of 25 per cent.

Stoke-on-Trent. — Price Increase. — The T.C. has increased the price of energy by a further 20 per cent., a total advance of 60 per cent.

Swanage.—Price Increase.—The Electric Supply Co. has informed the U.D.C. of its intention to apply to the B. of T. for authority to raise the price of energy to 10d. per unit. The Council has decided to ascertain the existing rates in other towns, and if these are the same, no action will be taken in the matter.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Wages.—Last week the 12½ per cent. bonus was granted to the Corporation employés in the gas and water departments and to the men engaged on the permanent way and at the tramway depôts. The Committee on Production orginally reserved its decision with regard to the traffic employés, and finally placed the responsibility on the Corporation. The motormen and conductresses decided to cease work, as from last Saturday night, if the award were not granted. A Conference, presided over by the Lord Mayor, was held at the Council House, on Saturday, and it was agreed that it was impossible to differentiate between the shed and permanent-way men and the traffic staff. The 12½ per cent. bonus, as from December 15th, was granted to the motormen, and 3s. 6d. per week to women over 18, and 1s. 9d. to those under 18.

Blackburn.—Strike Notice.—The secretary of the Amalgamated Association of Tramway Workers notified Mr. Cowell (tramway manager), on behalf of the members of the branch, of their intention to withdraw their labour on March 28th. The questions in dispute are the alleged improper payment of the recent awards by the Committee on Production and the alleged dismissal of a driver for refusing to teach driving to any other persons than discharged sailors and soldiers.

Bradford.—Wages.—After four days' idleness the Bradford cars resumed service on Wednesday last week, the Committee on Production having agreed to adjudicate as to the interpretation to be placed on the recent national award of £1 per week above prewar rates of pay, with regard to the women employés of the tramway undertaking. The Bradford women are paid at the same rate of wage as the men conductors, but receive a lower war bonus, and the Tramways Committee, therefore, contended that they were not included amongst the women to receive the £1 award—a contention which was upheld by inquiry of the Committee on Production. Representatives of the two parties met and signed an agreement to use their best endeavours to prevent a repetition of the strike, and for that purpose they will meet in conference if and when any dispute arises, and will take any other steps which will tend to an amicable settlement, it being the declared wish of both parties that such differences shall be settled in a constitutional manner. The matter was to be heard by the Committee on Production on Thursday of this week.

Doncaster.—Strike.—The municipal workers' strike is continuing, and forced the stoppage of the cars on Tuesday last week, owing to workers in the sheds and in the electricity department being concerned in the dispute, though the bulk of the tramway employés were content with the recent national award. The electricity service has been maintained. The cause of the strike is a demand for a further increase of 8s. per week for men and 4s. for youths.

Edinburgh.—In view of the tramways being taken over by the Corporation next year, a Sub-Committee of the Tramway Committee recommends that a manager of the undertaking should be appointed.

Leeds.—Wages.—The Committee on Production is being consulted on the position of the women who do not yet receive a bonus, owing to their not having completed three months' service.

[illegible] result of the increased bonus to tramway employés is expected to be an advance in fares. In January the tramway manager (Mr. J. B. Hamilton) prepared an estimate of the result of the year's working; but, in view of the recent wage advance and increased cost of materials, he has been requested to prepare a further report, which will be made in the light of the receipts of the undertaking up to the end of the financial year, which is getting near. About Easter new stopping and starting arrangements in the centre of the city will come into operation, to avoid the present congestion. The quene system will be extended.

Nottingham.—The T.C. has applied to the B. of T. for a further extension of time until August 15th, 1919, for the completion of work in connection with the tramways from Beeston to Nottingham.

Parcel Service.—In the House of Commons on Wednesday, March 20th, Mr. Wardle informed Mr. Gilbert that tramway undertakings had power, generally speaking, to carry parcel traffic. The attention of tramway authorities had been called to this point, and he was inviting the Tramways Committee of the Board of Trade to consider it.—*Evening News.*

Railway Workers' Wages.—According to the *Evening News*, the Underground Railway workers' wages dispute has been settled in favour of the men. The question, which was referred to the Committee on Production, was whether the overtime payment of Sunday work granted by railway companies to members of the two Unions engaged on Sunday shift in the generating and power stations of the railways should, or should not, be merged in the 12½ per cent. bonus. The Committee has decided that the extra payment for such work should not be merged in the bonus. The decision will mean an addition of about 4s. a week to the men's earnings.

Mr. J. H. Thomas, M.P., has been instructed by the Executive Committee of the National Union of Railwaymen to apply for a review of the existing wages agreements with a view to an increase, in the light of the altered circumstances, the decision to become operative as from March 31st. A demand that all women shall be paid the same war wages as those paid to men has also been decided on.

The Electrical Railway Workers' Committee has, at the same time, presented a further demand for an advance of 10s. per week.

Salford.—Increased Fares.—The Corporation Tramways Committee has decided to increase the fares, and the matter has been referred to a Sub-Committee. The new scale will probably come into operation in about six weeks' time. The recent further war bonus to motormen and conductors means an added increase of over £20,000 a year.

Tramcar Drivers.—The Home Secretary has decided to grant certificates to discharged soldiers to act as tramcar drivers on the Metropolitan Tramways at the age of 19.—*Pall Mall Gazette.*

TELEGRAPH AND TELEPHONE NOTES.

The Lag in Wireless Time Signals.—Some experiments were recently conducted by F. D. Orie, of the United States Naval Observatory, on the lag in wireless time signals between Arlington and Great Lakes Station. The lag was found to be approximately 0·085 second, with a probable error of 0·002 second.—*Scientific American.*

South Africa.—A European has been sent to prison for three months without the option of a fine for using insulting language to an operator at the Johannesburg Central Telephone Exchange.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdare.—March 31st. Electricity and Tramways Department. Stores for 12 months. See "Official Notices" February 22nd.

Aberdeen.—April 9th. Electricity Department. One 5,000-kw. turbo-alternator, surface condenser, and auxiliaries. See "Official Notices" March 22nd.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Darlington.—March 29th. Electricity Committee. Water-tube boiler, economiser, cooling tower, fan, and feed pump. See "Official Notices" March 15th.

Edinburgh.—March 30th. Electric fittings, &c., for Midlothian and Peebles District Asylum, Rosslynlee. Clerk and Treasurer, [illegible] Heriot Row, Edinburgh.

Manchester.—April 2nd. Corporation Electricity Committee. For Moss Side sub-station. Three 3,000 K.V.A. [illegible]-volt, three-phase, static transformers. Specifications, &c., from Mr. F. E. Hughes, Electricity Department, Town Hall.

Middleton.—April 8th. Electricity Committee. Two 500-kw. motor converters and E.H.T. switchgear. See "Official Notices" to-day.

Spenborough.—April 10th. District Council. Works required for extensions at electricity works. Engineer, Mr. A. Rothera, M.I.M.C.E., Town Hall. (Plans three guineas for complete set of quantities, or one guinea for separate trades, returnable.)

CLOSED.

Southend.—T.C. Two 2-ton electric wagons. Messrs. Ransome. Sims & Jefferies. Ltd Total cost £2.067. The Tramways Committee has accepted the tender of Messrs. Edgar Allen & Co.. Ltd., for six tramway tongues, at £7 15s. each.

Stepney.—Electricity Committee.

E. Foster & Co.—1,000 tons nutty slack, 24s. 7d. ton. 3,000 tons West Cannock D.S. nuts, 28s. 4d. ton. 2,000 do. 2 in. nutty slack, 22s. 10d. ton.
Bradbury & Co.—150 tons Pooley Hall slack, 21s. 10d. ton.

NOTES.

The Marconi Case.—In reply to Sir Charles Hobhouse's letter. mentioned in our last issue, Mr. Godfrey Isaacs wrote to him as follows :—

Sir,—I have received your letter of yesterday. Your solicitors requested the company's solicitors to excuse your attendance. as they presumed it would be unnecessary to call you as a witness. The company's solicitors replied that they could not do so, but that, provided you attended on the first day of the hearing, they would study your convenience as far as possible with regard to your subsequent attendance. Presumably it was because this was not satisfactory to you that you then took the unusual course of writing to the learned Judge.

1. You have for three years refrained from testing the accuracy of the statements of which you now complain.

2. You have failed to take advantage of the opportunity recently given to you to go into the witness-box and submit yourself to cross-examination.

3. You have adopted the "safe" course of availing yourself of the protection afforded to you by the House of Commons, where your statements could not be tested, and of attacking me there, where my hands are tied : and

4. When I invite you to come into the open, so that your veracity and honour and mine may be put to the test in open Court, you refuse to do so.

It is, as you say, for the public to draw their own inference, and I confidently invite them to do so.—Yours truly,

Godfrey C. Isaacs.

Marconi House, Strand, W.C. 2, March 21st.

The following letter was sent by Sir Charles Hobhouse to Mr. Godfrey Isaacs on March 22nd :—

Sir,—I have received your letter of yesterday's date. I was subpœnaed only to produce certain documents, and my solicitors wrote stating that I had not, and never had had, any such documents.

They suggested, therefore, that it would be unnecessary for me to attend the Court for that purpose, but asked, if my attendance was still required, for some explanation as to why it was required. They did not request the company's solicitors to excuse my attendance.

You assert that I am sheltering myself behind the privileges of the House of Commons. The attack made upon me through the counsel for the Marconi Co. is, I am advised, and you must be aware, also privileged In order to give you every opportunity of testing the accuracy of our respective statements, if you so desire, I hereby state :—

(*a*) That the allegations contained in the letter which you say you received from the Telefunken Co., so far as they concern myself. are false.

(*b*) That the account which you gave in a letter to Lord Gainford of June 29th, 1916, of a private interview between us on February 6th, 1915, is in many respects wholly untrue, and in others misleading. For instance :—

1. Your statement that I made an offer to the Telefunken Co. is untrue.

2. Your statement that I recognised that, as a Minister of the Crown, I should not have made this offer is untrue.

3. Your statement that I asked you : "What it was your intention to do." and that I said : "You had your foot on my neck ; did you intend to crush me, which would mean my leaving the Government, or were you disposed to help me ?" is untrue.

4. The whole of the following statement :—

"I told him that I had no desire to make use of the letter unless I was compelled to do so, and that if any settlement of the Imperial Contract matter could be arrived at. which I would do everything in my power to assist, there would be no reason whatsoever for the letter ever being disclosed. He thanked me sincerely for this assurance," is untrue. Yours faithfully,

C. Hobhouse.

At the instance of Mr. Godfrey Isaacs a writ was issued against Sir Charles Hobhouse for libel on Monday last.

Supply Engineers' Salaries.—A report of the Lighting Committee of the Barnes U.D.C. states that it considered a draft resolution which was submitted to the Conference of local authorities owning electrical undertakings in Greater London on the question of the salaries of chief engineers, but decided to take no action. as it was of opinion that the Conference should not interfere with the question of the engineer's salary so far as that district was concerned.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending April 6th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Monday, April 1st.—Commandant's Parade at Waterloo Station, 8.45 a.m. for inspection at Esher. Marching order, with rifles. Mid-day and tea rations to be carried.

Tuesday, April 2nd.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting at 7.30.

Wednesday, April 3rd.—No. 1 Company, Entrenchments, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, April 4th.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, April 5th.—Musketry, 5.30—6.

Saturday, April 6th.—Musketry, 2.45—4.45. Knotting for the whole Corps, 2.45—4.45.

Special Notices.—On March 31st, all D and R men who have not signed the A and B Agreement will be discharged automatically.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The Utilisation of Bavarian Water Powers.—An important step in advance in connection with the utilisation of the large water powers in Bavaria is reported to have just taken place by the formation with the co-operation of the Bavarian Ministry of two syndicates for dealing with the powers of the Upper Inn and the Central Isar repectively, which are the two Bavarian rivers which are still free and which have been reserved for industrial purposes. In the case of the Inn three power sections come under consideration. The central section near Jettenbach is intended for the Imperial aluminium works, which is to be erected after the conclusion of peace, and 50,000 H.P. is to be utilised. The question concerns an expenditure of about £3,000,000. The upper section from Kufstein down to Attal is expected to yield 60,000 H.P., whilst a further 50.000 H.P. is to be obtained between Muhldorf and Simbach. The negotiations which have now been brought to a provisional conclusion concern the Inn above the projected aluminium works.

The Isar from Puppling down to the mouth has already formed the subject of projects and partly been assured to various interests. The uppermost section near Puppling has been reserved for the State Railway Administration. Near Iching a section has been conceded to the Isar works, and the utilisation of a large portion of the power has already been guaranteed by contracts, although this section will only be developed by the Isar works after the war. A scheme for about 70,000 H.P. is contemplated below Moosburg to the Danube by the General Electricity Co., of Berlin, whilst the central section from Munich to Moosburg is interesting the city of Munich for ensuring the latter's supply and also industrial concerns. It seems now to have been possible so to arrange the various schemes that both the needs of the city and of industries can be satisfied, as results from the fact that the Munich City Council has joined the second syndicate which purposes to utilise these sections of the Isar. The most satisfactory consequences of the negotiations are that all interests have been brought together for common action, and thus the competition for concessions which has frequently prevented practical work has been avoided.

The basis of both syndicates is formed by the constituents of the Bavarian Water Power Community, which is composed of the Bavarian Mortgage & Exchange Bank, the Bavarian Verein Bank, the Bavarian Commercial Bank, the Bavarian Discount & Exchange Bank, and the Nuremberg Electricity Co. (late Schuckert). The Water Power Community was formed last June as an investigating commission to take stock of the free water powers still available, to examine as to their utilisation, prepare projects, and induce manufacturers to establish industries and co-operate in the flotation of the requisite capital. The Water Power Community has now been expanded for the execution of the work of opening up the Upper Inn and the Central Isar that is now in hand. In the first place, the raising of the necessary funds will require further assistance, and in this respect the support of the Disconto Gesellschaft, of Berlin, has been obtained, together with that of the banking firm of Freidmann, Bleibtreu & Co., of Berlin, who were already interested in the development of Bavarian water powers through the Leitzach works. Secondly, the technical side has been, amplified in the syndicate for the Upper Inn by the accession of the Metal Bank and Metallurgical Co., of Frankfort-on-Main, and the Griesheim-Elektron Chemical Works Co., of Frankfort, and the syndicate for the Central Isar by the inclusion of the Fried. Krupp Co., of Essen, and the same company's gun factory at Munich.

Copper for Electric Wire in Sweden.—The use without licence of copper for the manufacture of certain kinds of electric wire has been prohibited in Sweden by a Royal Decree dated November 9th. The prohibition came into force on December 1st. It is provided in the Decree as follows :—

"For the manufacture of such electric wire, enclosed in an insulating substance. as contains a conducting area of six square millimetres or less. copper shall not be used without a licence from the Executive Committee of the Industrial Commission."

The object of these regulations as officially stated in a Press communiqué. is to ensure that copper shall only be used in cases where substitutes are not available, notably in the manufacture of electric machines and transformers. It is also stated in the Press that zinc can conveniently be used as a substitute for copper in indoor wiring ; that the supply of zinc in Sweden is abundant ; that the manufacture of zinc electric wire has been successfully taken up in Sweden ; and that the country's requirements of that material can be provided in the country itself.—*Board of Trade Journal.*

Whitley Committee.—The *Times* states that steps are being taken to form a National Council for the iron and steel trades on the lines of the Whitley report.

Appointments Vacant.—Shift engineer (70s.), for the City of Lincoln Electricity Department; electrician (63s.) for the Portsmouth Corporation Tramways; assistant lecturer in electrical engineering (£175 plus 5s. per hour for evening classes), for the City of Hull Education Committee; engineer-in-charge, also engine-driver, for the Corporation of Tunbridge Wells Electricity Works; shift engineer (£213) for the Edinburgh Corporation Electricity Department; two switchboard and sub-station attendants (50s. to 65s.) for the Salford Corporation electricity department. See "Official Notices" to-day.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—A joint meeting with the Colliery Managers' Association was held at Stoke, on the 9th inst., when a paper on "The Care and Testing of Colliery Electrical Cables" was read by Mr. A. F. W. Richards.

Institute of Metals.—The report of the Council for the year 1917 shows that war conditions have stimulated the activities of the Institute, and have led to a very large increase in the membership, which has risen from 660 to 888 during the year, a net increase of over 34 per cent. At least 72 members are on active service. The Government grant to the Corrosion Research Committee has been increased from £650 to £1,000 a year; a further grant of £450, with a like sum from the B.E.A.M.A., has been devoted to an investigation into the causes of corrosion of condenser tubes by fresh water, and a Freshwater Corrosion Research Committee has been appointed. The hon. treasurer's report shows an excess of receipts over expenditure of £698, compared with an average of £156 for the four preceding years.

Royal Institution.—Amongst the arrangements for lectures after Easter are the following:—Prof. John Joly, two lectures on "Scientific Signalling and Safety at Sea"; Lieut.-Colonel C. S. Myers, two lectures on "Present-Day Applications of Experimental Psychology."

Institution of Electrical Engineers.—At the meeting on Thursday, last week, before Dr. Barclay's paper was discussed, the president stated that Mr. C. P. Sparks had generously presented to the Institution a portrait of Galileo, which was exhibited in the Lecture Theatre. The thanks of the Institution were cordially awarded to the donor.

A joint meeting of the Institution and the Electrical Section of the Royal Society of Medicine will be held at the Cancer Hospital, Fulham Road, S.W. (between Nos. 177 and 187), on Thursday, April 11th, at 7.30 p.m., when the following papers will be read:—Dr. E. P. Cumberbatch, "Diathermy: the Use of Electricity for Heating the Tissues of the Body in Disease"; Dr. R. Knox, "Single-Flash (Instantaneous) Radiography: Its Possibilities and Limitations." There will also be an exhibition of electro-medical apparatus.

Patents and Trade Marks.—In the *B. of T. Journal* for March 21st a report is given of the speech of the President of the Board in reply to a deputation in connection with the Bill now before Parliament. He pointed out that to extend the duration of patents to compensate the owners for losses due to the war would be to place patentees in the position of a privileged class, who were not to be penalised as the result of the war. That would introduce a contentious element prejudicial to the passage of the Bill. It was imperatively necessary to pass the Bill as soon as possible, and there was no need for a special Bill dealing with the life of patents, as the present Bill could be modified if required. He would do his best to get it through as quickly as possible. He expressed surprise at the opposition to Part 2 of the Trade Marks Bill; their desire was to help the trade interests of the country, and the representations of the deputation would be most carefully considered. The clause was intended to prevent the establishment of a perpetual monopoly of a commodity by the use of a word—a trick which had been practised particularly by the Germans; there was no intention to interfere with the legitimate use of trade marks.

In the same issue of the *Journal* the reports of the Departmental Committees on the Engineering Trades and Shipbuilding and Marine Engineering are quoted at some length on patent and trade-mark questions. The former Committee advocates the harmonising of the laws throughout the Empire, the acceptance of manufacture within the British Empire as complying with any manufacturing clauses in such laws, and the arrangement of similar fees. The clause of the Patents Act requiring manufacture in this country should be more stringently enforced, as by specifying a proportion to be so manufactured as compared with the total import of such articles under patents held abroad, and some competent body should be appointed to decide as to the reasonableness of the royalties and terms demanded for the grant of licences, without reference to the Courts. The onus of proof of manufacture in this country should be thrown upon the patentee. The value of ancillary patents intended to prolong the life of a master patent should be subject to challenge before the Controller, and the life of patents should be made 15 years throughout the Empire. The abuse of the patent laws of this country and Germany by Germans who secured "blocking patents" here and withheld patents in Germany from British citizens, should be dealt with, and the cost of Empire patents should be reduced. The validity of a trade mark should depend on priority of user, and not upon the date of registration.

The other Committee draws attention to the use of the Courts by wealthy litigants to create monopolies by the employment of procedure through injunction, leading to great injustice both to the individual and to the State.

Fatality.—An inquiry was held at Newcastle-upon-Tyne Infirmary, on March 20th, into the circumstances attending the death of Joseph Irwin Waugh, of Ryton-on-Tyne, who died from burns received at an electrical sub-station on the North-East Coast. It being necessary to inspect and clean some high-pressure bus-bars, to prevent workmen from coming into contact with the live conductors, screens were placed in position. One of these stuck, and while Waugh was pulling it back with an insulated pole there was a flash and an explosion. Waugh was burned practically all over the body, and another electrical engineer was burned about the face and hands. A subsequent examination showed that the screen had been dislodged, and caused a short-circuit. There was no defect in the screen. Verdict: "Death from shock due to burns."

A Stepney Boiler Contract.—According to the Stepney Borough Council Minutes, that body is recommended by the Electricity Committee to take steps in accordance with the opinion of Mr. J. Hunter Gray, respecting a contract with the Howden Boiler Co. for boilers installed at Limehouse station (£35,700). It is proposed that the Council's solicitor should address a communication to the Howden Co., rejecting the plant, and should commence legal proceedings against the company for damages for breach of agreement, &c. The situation arises consequent upon the refusal of the company to undertake the tests provided for by the contract, or to accept the results of the tests carried out between May, 1916, and September, 1916.

Legal.—Electric Furnace Patents.—In the King's Bench Division, on Monday, Mr. Justice Bray was asked to make a declaration that two contracts which Messrs. Grondal, Kjellin & Co., Ltd., iron and pyrites merchants, Abchurch Lane, London, had entered into with Siemens-Halske Aktiengesellschaft, of Berlin, became dissolved upon the outbreak of war.

Mr. Stuart Beavan, counsel for Messrs. Grondal, Kjellin & Co., stated that the matter was before his Lordship in December and January last, and was adjourned to enable the defendants to be represented. He now read correspondence which had since taken place with the agents of the defendants, showing that the latter did not wish to be represented, but that they were anxious that the rights of the American Iron and Steel Manufacturing Co., under an agreement with them dealing with these patents, should not be prejudiced. Defendants were not now represented. Counsel went on to explain that there were two agreements concerned in his application for an order. They related to patents for certain processes in the manufacture of electric furnaces used in the making of high-grade steel. By these agreements rights were given by the plaintiffs to the defendants in regard to certain territory. The territory covered by the first agreement was the United States and Canada. Under Clause 2 of this agreement, Siemens-Halske received the exclusive right to grant licences under the patents in the territory named. Payment was to be at the rate of two-thirds to plaintiffs and one-third to defendants in respect of the patent sales. Defendants were to have the right to cancel the agreement at the end of two years by giving six months' notice in writing, plaintiffs having a similar right, but neither party had exercised this right. Counsel understood that the American company mentioned in the correspondence were licensees under defendants of some of the patents, but if the order asked for were made, their rights would not be affected. The American company derived their rights from licences issued to them before the war. The second agreement was in the same terms, but the territory covered in this case was the British Colonies. His Lordship would see how very seriously the interests of this country would be crippled if no use could be made of these patents in America and the British Colonies during the war. The agreements involved constant communication between the plaintiffs and defendants, and plaintiffs' representative was in Berlin in connection with them when war broke out, and he was arrested, and was still interned.

His Lordship made the declaration asked for.

High-Pressure Test upon Rubber Gloves.—All new gloves received by the Rochester (N.Y.) Railway and Light Co. are tested before they are placed in service, and, in addition, receive occasional tests afterwards. The test is different from the ordinary one, in that 10,000 volts is applied while an ammeter is connected in series with the glove, so that the current passing through the glove can be observed. Tentatively, all gloves are considered unsatisfactory if the current exceeds 10 milliamperes.

One objection which has sometimes been raised to this test is that the glove might be weakened thereby, especially if the test is conducted frequently. To determine whether there was any ground for this objection, an ordinary glove which had been used considerably was subjected to 10,000 volts for 26 hours, at the end of which time it broke down at the surface of the water.

When it is considered that the tests are not liable to be applied more than one minute or one and a half minutes a month, it should be evident that this method of testing is harmless, even if the experiments do not prove it.—C. G. Brown, in the *Electrical World*.

The Electric Gun Again!—The bombardment of Paris by guns of extraordinarily long range has raised a crop of conjectures as to the nature of the weapon, including, of course, the electric gun. Exactly ten years ago (April 3rd, 1908, page 581) we showed, by the most elementary dynamics, that the idea of employing electric power for this purpose was utterly absurd and impracticable. But the lay Press is easily gulled by *soi disant* "electrical experts."

The Magneto Industry.—The remarkable development of the British magneto industry since the outbreak of war was discussed by the Edinburgh Rotary Club on Thursday last week, when the speaker was Mr. Peter F. Bennett, of Birmingham. He stated that the capital invested in the British magneto industry was approximately £1,000,000, and without including those engaged in subsidiary trades, it gave employment to 5,000 persons.

Proposed Super-power Station.—The Mersey Power Co. is in negotiation for a site for the erection of one of the super-power generating stations suggested by the Ministry of Reconstruction's Coal Conservation Committee. The directors of the Salt Union have decided to subscribe for another £100,000 of capital in the company, while the Ministry of Munitions has agreed to make a loan of £300,000.—*The Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—There were 41 applicants for the post of assistant electrical engineer at Cape Town. From a selected six of these the Electricity Committee recommended, and the Council approved, the appointment of MR. A. G. VAL DAVIS, electrical assistant to the maintenance engineer of the Victoria Falls Power Co.

The L.C.C. Highways Committee recommends a number of promotions in the tramway department. These include :—MR. W. P. FARQUHARSON, general assistant and acting chief clerk, to become chief clerk, and to be advanced from £600 to £800; MR. H. VORLEY, tramway accountant, advanced from £500 to £550, rising to £600; MR. R. E. FARBRIDGE, assistant accountant, to be senior assistant; MR. T. R. IRELAND, assistant in the third class, to become claims superintendent, and to be advanced from £190 to £300; MISS E. HODGE becomes superintendent of women checkers at £250.

Luton Electricity Committee has decided that, in consideration of the electrical engineer's administrative staff withdrawing their claim to take advantage of the 12½ per cent. increase of wages granted under the award of the Chief Industrial Commissioner, increases of salary be granted as follows, as from March 1st :—MR. H. A. KELL (chief assistant), from £240 to £265; MR. A. H. GATES (chief technical assistant), from £225 to £250; and MR. R. HARDING (chief clerk), from £175 to £200.

The Keighley Tramways Committee recommends that the salary of MR. HARRY WEBBER, the borough electrical engineer, as tramway manager, be increased from £100 to £175 per annum.

The proposal of the Blackburn Electricity Committee that £500 should be given out of war profits to MR. WHEELWRIGHT, the borough electrical engineer, has been postponed.

Liverpool Tramways Committee recently decided to create the office of deputy manager. It has now recommended the appointment of MR. J. S. D. MOFFETT, general manager of the Belfast Corporation tramways to that position.

MR. JOHN SCOTT, station superintendent at Accrington Corporation electricity works, was caught by a moving wagon at the works on March 20th, and had his hips badly crushed.

MR. H. R. FORBES MACKAY, electrical engineer of the Sydney Municipal Council, has returned to Australia after a short visit to Canada and the United States.—*Commonwealth Engineer.*

General.—MR. ARCHER SMITH, who for the past five years has been district manager of the Post Office telephones in the Belfast district, has been appointed to the district managership of telephones in the Newcastle-on-Tyne district.

Roll of Honour.—SAPPER GEO. MORLEY, R.E., killed in Italy by a bomb, was prior to the war in the electrical department of the post office at Carnforth.

PRIVATE C. P. COPSON, Leicestershire Regiment, engaged in the electric light department of the Midland Railway Co. at Leicester, is reported killed after being listed as wounded and missing.

PRIVATE J. SHELMERDINE, Ashton Territorials, who has been awarded the Military Medal, was employed at the Ashton-under-Lyne Corporation electricity works.

The death from wounds, while a prisoner of war, is announced of LANCE-CORPORAL H. J. KING, Worcestershire Regiment, formerly employed at the electrical accessories works of Messrs. Vickers, Birmingham.

CITY NOTES.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

At the annual meeting, on March 21st, Mr. J. H. ARMSTRONG, the chairman, said that the capital expenditure for the year had been £202,647, mainly incurred at Carville and Dunston power stations. It was hoped that by the end of the current year the whole of the extensions at Carville would be carried out, and, when that was done, that station would be complete, as they had no further room for extensions there, and the station would then have a capacity of 120,000 H.P. The alteration they had made in connection with the reserve and depreciation accounts had necessitated a change in setting out their profits, so that it had been impossible to give as clear a comparison of the figures with the year 1916 as might have been desired. On the same basis as the 1916 figures, the profit for the past year—before setting aside anything for depreciation or reserve—was £281,915, as compared with £224,266, an increase of £57,649. The amount available for dividend was £136,607, as against £108,889 in 1916, of which £64,325 was required for the preference dividend, an increase of £18,708 over 1916, owing to the increase of that class of share which was necessary to carry out the exchange with the Cleveland shareholders on the Newcastle Co. acquiring their interest in the Cleveland Co. The chairman then explained the change that had been made in regard to the reserve accounts. They had now acquired practically the whole of the shares in the Cleveland Co.—at present they held, he thought, 99 per cent. At their last meeting the belief was expressed that before many years the Tees district would hold a leading position in industrial enterprise on the North-East Coast, and it was also mentioned that the Cleveland Co. had received many applications for the supply of current, both from its existing customers and in connection with new manufacturing undertakings, which the Cleveland directors had not seen their way to meet, owing to the difficulty of financing. The expectations of the Newcastle board in connection with such developments had been realised somewhat more quickly than they anticipated, and he was pleased to state that the terms had been arranged for the supply of large quantities of electrical energy by their newly-associated company to new customers, who were now erecting works in the Tees area. In order to meet these orders for current it was necessary that further generating plant should be provided, and for this purpose a suitable site had been secured upon which a new generating station was in course of erection. The site was situate on the north side of the river Tees, with ample river frontage, good access to the North-Eastern Railway, and by road immediately behind it, and, furthermore, it was situate at a point where their interconnecter cables passed through from Durham into Yorkshire. The Tees Power Station Co., Ltd., had been formed under the auspices of the Newcastle Co., and inasmuch as the site selected, for the erection of this new generating station was a considerable distance outside the Newcastle Co.'s area of supply, and partly for financial reasons, it was considered advisable that this new station should be erected and owned by a separate company. Of the £700,000, £200,000 of shares had been allotted to this company, and £50,000 had been paid up thereon, while £600,000 had been raised by the issue of 6 per cent. first mortgage debentures. The plant in this station would, in the first instance, consist of two turbo-alternators, having a total capacity of 53,000 H.P. Arrangements had been made under which the Newcastle Co. would lease and operate the station, and all energy produced therefrom would be sold and distributed by or through the Cleveland Co. The chairman said they would probably have seen the references in the Press in connection with the report of a Sub-Committee on Electric Power Supply, and the references made to the Newcastle companies. He spoke upon the development of that company from the time when it was supplying light to a portion of the city, and how it was developed into a power company. At that time they consulted Messrs. Merz and McLellan, whose scheme for supplying power through a large area was adopted by the directors. It was a complete scheme of development, which was practically the same as that in being to-day. This was not only the first comprehensive power scheme in the country, but the first of its kind in the world. The area now controlled by this company was some 1,400 miles. Throughout that area they were dealing with either the whole of the power supply, or had intimate working relationships with the local authorities, with the exception of Sunderland, South Shields, and Darlington. He should like to make it quite clear that they were ready to discuss inter-working arrangements whenever those authorities desired to do so, but no attempt would be made to extend their powers of general supply over their areas, or compel them to make working arrangements with that company. Referring to the Coal Conservation Committee's report, he said there was one matter to which he wished to refer. As a reply to the somewhat eulogistic remarks that were made by the Government Committee, and the general suggestion that that company's undertaking might be taken as an example of what was required to secure a cheap supply of current on a large scale, one of their shareholders had recently issued a pamphlet, one of the objects of which appeared to be to question the accuracy of the finding of the Government Committee as to the cheapness of the company's supply to their consumers. He thought they could be satisfied from the fact that that Committee was composed of electrical and other experts, that they not only knew exactly what information they required, but also that they admitted nothing as accurate until it had been proved to the hilt, and it was, he considered, a sufficient answer to that point to state that the average prices at which they supplied electricity to their customers (not by one associated company to the other) were lower than the average prices offered by any other undertaking. There was one point in which he was in entire agreement with this shareholder, viz., that it would be a great simplification if this company and all its associated companies could be amalgamated into one, owning and operating everything through the entire area which they now controlled, but the present position was not of their seeking, and the only way in which that company could extend its area was as a holding company, by acquiring the interests of local and adjoining companies. Referring to the proposed increase of capital, the chairman said that the directors had come to no decision as to when, and to what extent, it might be advisable to make an issue of further capital, but in view of the largely increased demands which were being made upon them, &c., they thought it well to take the step in good time.

Dr. Merz seconded the adoption of the report.

Mr. A. Gemmell criticised certain items in the report, and said the chairman had not convinced him that the business was on a sound basis. He acknowledged having issued the pamphlet referred to, and said its reception in influential circles justified its publication.

The report was adopted.

An extraordinary meeting followed, at which an increase of capital was sanctioned to the extent of £790,000, 205,000 preference shares of £1 each, and 585,000 ordinary shares of £1, making the present authorised capital of the company £3,000,000.

British Aluminium Co., Ltd.—The financial result for 1917 was recorded in our last issue. The report states that the hydraulic works at Kinlochleven, for the provision of additional water supply to the Blackwater reservoir, were sufficiently completed to enable the water from Loch Eilde Mhor to be utilised as from the beginning of this year. The alumina works at Burntisland are now practically complete, and the manufacture of hydrate of alumina has been proceeding for some months. The output of aluminium has been used entirely for munition purposes, and the price of the metal has been fixed by the Government. The company is making application to Parliament during the present session for the necessary powers to develop a further large water power in Scotland, situate in the County of Inverness, in proximity to the Kinlochleven factory.

Clyde Valley Electrical Power Co.—Profit for 1917, £89,304, plus £25,797 brought forward. After paying net interest and preference dividend, putting £50,000 to contingency fund for depreciation, £7,587 to special reserve, and paying 2½ per cent. for the year, free of tax, on the ordinary shares, £21,146 is to be carried forward. The amount of excess profits' duty as adjusted to June, 1917, also provision for the estimated assessment for the December half-year, are included in the item "Rates and Taxes" in the revenue account. The extensions to Clyde's Mill power station have been completed, and the plant is in operation. A 15,000-kw. turbo-alternator is being added at Yoker power station. Mr. P. A. Lang has retired from the board, and Mr. J. W. Cloud has taken his place.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The report for 1917 shows a net income, after providing for debenture interest and making provision for deferred repairs, of £32,521; £15,952 was brought forward, making £48,474. Dividend 6 per cent., less tax, on preference shares; £5,000 to purchase of funded preferential dividend certificates; £12,456 is put to renewals, depreciation, and reserve fund; and £20,609 is carried forward.

Mackay Companies.—The report states that income from investments in other companies was $4,519,364, and dividends paid on the Mackay Companies shares $4,425,198. Operating and other expenses, including Federal income-tax, amounted to $89,058, the balance carried forward being $5,108.—*Financial Times.*

Sunderland District Electric Tramways, Ltd.—Interest at the rate of 3 per cent. per annum, less tax, is to be paid on the first income bonds, and £898 carried forward. There was an increase of £5,136 in traffic receipts during the year, but working expenses were considerably higher. The net result is an increase of £666 in profit.

Salisbury Electric Light & Supply Co., Ltd.—The profit for 1917, including £2,118 brought forward, was £7,831. Debenture interest absorbs £799, a dividend of 6 per cent. is paid for the year, £2,000 is put to depreciation and reserve, and £2,906 is carried forward.

Newmarket Electric Light Co., Ltd.—During 1917 the lamps connected (33-watt) were 1,012, making the total 32,937. Profit, including £483 brought forward, £2,503. Debenture interest £710, dividend 2½ per cent., £750 to reserve for plant renewal, carrying forward £379.

Hastings & District Electric Tramways Co., Ltd.—After paying 6 per cent. on the preference shares, £2,500 is carried to depreciation, £4,810 is put to reduction of suspense account, and £861 is to be carried forward.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors recommend a final dividend on the ordinary shares of 10 per cent., less income-tax, making 15 per cent. for the year, and also a bonus of 10s. per share, less income-tax.

Waste Heat and Gas Electrical Generating Stations, Ltd.—During the year ended at January, 1918, the profits, after deducting administration expenses, were £40,731, against £40,080 in the previous year. £12,000 of this has been put to reserve. Including £19,411 brought forward the available profit is £48,142, as against £45,511. After transferring £5,000 to experimental expense account, and paying 8 per cent. dividend, £17,542 is to be carried forward. After considerable delay the whole of the new generating plant for the Weardale power station is on site, and undergoing preliminary trials. The plant will be more expensive than was anticipated, and the starting up involves expenditure of an experimental nature. Arrangements have been made for carrying out certain experimental work jointly with the Newcastle-upon-Tyne Electric Supply Co., Ltd., which it is hoped will further the company's interests. Progress has not yet been possible in connection with the proposed station at Horden, but the sanction to proceed has been received from the Ministry of Munitions, and contracts are being prepared. Constructional work will proceed as rapidly as conditions allow. The company's plant at Tees Bridge, the smallest of the company's power stations, had to be closed down last July owing to an alternator breakdown. It is now undergoing repair. Revenue from units generated by the company is 4 per cent. less than for the previous year.

Brompton & Kensington Electricity Supply Co., Ltd.—The credit balance for 1917, including the amount brought forward and interest received, was £35,700. After paying the preference interest, 10 per cent. on the ordinary shares, putting £10,000 to reserve, writing £337 off investments, and putting £1,000 to directors' additional remuneration, £5,217 is to be carried forward. The equivalent of 35-watt lamps connected increased by 38,095 to 383,839. Customers increased by 182 to 6,860. The gross receipts were £61,898, against £55,878 for 1916. The expenditure fell from £31,940 to £31,580. The net receipts advanced from £23,938 to £30,319. Average price per unit fell from 4.1d. to 4.05d. The dividend increased from 9 per cent to 10 per cent. Meeting: March 28th.

Tucuman Tramways, Light & Power Co.—According to a financial contemporary, the accounts, after payment of debenture interest, show a loss of £14,093, making a total debit balance of £49,304 to be carried forward.

Mirrlees Watson Co., Ltd.—Dividend, 12½ per cent.

STOCKS AND SHARES.

Monday Morning.

The great battle absorbs all other considerations. Stocks and shares are relegated to a background. There seems to be something anomalous, to put it mildly, in Stock Exchange affairs what time life and death struggle with such furiousness on the Western Front. Business in securities is therefore very quiet, and the quickening of demand for War Bonds is expected as a matter of course. This would tend to make gilt-edged stocks dull, and, in this connection, it may be mentioned that quotations for Home Railway prior-charge securities are going down steadily. Market opinion ascribes this to the "Tank" campaign and its after-effects.

Metropolitan Railway 3½ per cent. preference have recently weakened to 54½, and the 5 per cent. preference to 74½. London Electric 4 per cent. preference can be bought at a little under 60, giving a yield of £6 13s. 6d. per cent. on the money. The company's 4 per cent. debenture stock last changed hands at 66½. District 4 per cent. prior lien debenture stands at 70. Underground Incomes—to drop into another class of security—are heavy at 79.

The Brompton & Kensington Electricity Supply Co. is another which did well last year. A final dividend at the rate of 12 per cent. makes 10 per cent. for the twelvemonth, as against 9 per cent. in the previous period. The reserve fund is raised to £55,000, and the directors take an additional remuneration of a thousand pounds. Brompton ordinary have risen to 6¾, and still yield a handsome return upon money invested in them. Westminsters continue to be a weak market at 6⅜, and there appear a good many shares still on offer. When once these are taken, Westminsters can be almost counted upon to recover. Kensingtons are better at 5½. No change of consequence has taken place in the City group.

The flatness of gas stocks, alluded to recently, has been stayed by the semi-official promises of concessions to the companies, these concessions being expected to take the form of some modification of the sliding scale applicable to the dividends permitted to be paid as governed by the price of gas.

The granting of an additional hour to theatres, whereby they can remain open until 10.30 p.m., is regarded in Stock Exchange quarters as on a par with many other actions of the Government.

Telegraph investments are noticeably good because of the imminence of the Budget, and the probabilities of further taxation. This gives a renewed fillip of popularity to companies paying dividends free of tax on their ordinary capital, although it has to be remembered that there is no guarantee of the continuance of the practice. Still, the leading cable companies occupy positions of such commanding strength that they, at any rate, are not likely to make any departure from previous principles; hence the rises in Eastern Extensions, Westerns and Eastern Telegraphs. Globes keep very steady at 14¼. Marconis suffered from a little profit-snapping after their sharp rise on the result of the company's law-suit, and the price eased off to 3 7/16 sellers. American Marconis, on the other hand, present a better front at 25s. Oriental Telephone and United River Plates are both firmer, while Panama ordinary remain somewhat heavy.

W. T. Henley's Telegraph ordinary shares are to receive 10 per cent. dividend, making 15 per cent. for the year, plus a bonus of 10s. per share, bringing up the total to 25 per cent., the same as for 1916. The share distribution is, of course, the plum, and Henley's hold their rise at 19¼. General Electrics have advanced to the level £20, twice their nominal par value, and it is considered that although the company appears to be paying a high price for Fraser & Chalmers's Erith works, the bargain is likely to turn out favourably for the General Electric. A further spurt in Callender's to 18¼, another jump in India-Rubber shares to 16⅝, a partial recovery of the dividend and bonus just deducted from the price of Telegraph Constructions, are illustrative of the strength in this department.

Electrical manufacturing shares continue quiet. Engineering issues are undecided. Babcocks are a trifle easier. Chemicals keep good, supported by rumours of a combination of interests. Castners rose to 3⅝. The rubber share recovery has made further upward progress. Speculation in tin mining descriptions ebbed away as the price of the metal reacted after its big rise.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price March 22, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅜	+ ¼	£7 8 0
Charing Cross Ordinary ..	5	5	8⅞	− ⅛	6 18 0
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	3	3	—	5 4 4
City of London	8	8	12⅞	—	6 4 8
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
County of London	7	7	11⅛	—	6 6 0
do. 6 per cent. Pref.	6	6	10⅜	—	5 18 5
Kensington Ordinary	6	7	6½	+ ⅛	6 8 0
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	8 0 0
Metropolitan	3	4	3⅝xd	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	3½	—	6 13 4
St. James' and Pall Mall ..	8	9	7⅛	—	6 6 4
South London . ..	5	5	2 1/16xd	—	7 2 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅜	− ⅜	7 0 6

TELEGRAPHS AND TELEPHONES

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	88/6	1½	12⅜	—	6 18 4
Chile Telephone	8	8	7¼	—	5 10 4
Cuba Sub. Ord.	6	7	9¼	—	*7 11 4
Eastern Extension	8	8	15⅜	+ ⅛	*5 4 0
Eastern Tel. Ord.	8	8	153½	+2	*5 4 6
Globe Tel. and T. Ord.	7	7	14¼xd	—	*4 18 3
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	22	24	[illegible]	—	6 11 6
Indo-European	18	18	51½	—	6 6 8
Marconi	10	16	3 7/16	—	4 8 0
Oriental Telephone Ord. ..	10	10	4¼	+ 1/16	2 7 1
United R. Plate Tel.	8	8	6⅞	—	*5 17 4
West India and Pan	6d.	6d.	1⅜	—	*3 17 0
Western Telegraph	7	8	15¾	+ ⅛	*5 2 5

HOME RAILS

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield p.c.
Central London. Ord. Assented	4	4	61½	[illegible]	6 10 7
Metropolitan	1	1	30¾	− ¼	4 15 8
do. District	Nil	Nil	14½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A" .	Nil	Nil	5/-	—	Nil
do do Income	6	4	79	− ½	*5 1 6

FOREIGN TRAMS &c

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams. First Pref.	5½	5½	2⅞	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66½	—	7 10 6
Brazil Tractions	4	4	44½	—	—
Bombay Electric Pref.	6	6	9¼	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	52½	− ½	9 12 4
do. do. Preferred	Nil	Nil	32½	− 1	Nil
do. do. Deferred	Nil	Nil	27½	− ½	Nil
do. do. Deb.	4½	4½	53xd	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	82½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	[illegible]	—	Nil
do. 1st Bonds ..	Nil	Nil	86½	−1½	—

MANUFACTURING COMPANIES

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield p.c.
Babcock & Wilcox	15	15	3 7/16	− 1/16	4 5 9
British Aluminium Ord. ..	7	10	1 23/32	—	6 0 9
British Insulated Ord.	17½	20	8¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 15/16	—	5 2 0
Callenders	20	20	18¼	+ ¼	5 9 9
do. 5 Pref.	5	5	4	−	6 5 0
Castner-Kellner	22	20	3⅝	+ 1/16	5 10 2
Edison Swan. fully paid .	—	-	2½	—	Nil
do. do 4 per cent Deb	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1½	—	6 0 0
Gen. Elec Pref.	6	6	10⅜	—	6 15 8
do. Ord. ..	10	10	20	+ ½	5 0 0
Henley .	15	15	19¼		6 8 2
do. 4½ Pref	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	16⅝	+ ¾	*6 2 6
Telegraph Con.	20	20	42xd	+ ⅜	*5 18 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Monday, March 25th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/6	..
a	Ammoniac Sal	per ton	£75	..
a	Ammonia, Muriate (large crystal)	"	£72	..
a	Bisulphide of Carbon	"	£23	..
a	Borax	"	£38	..
a	Copper Sulphate	"	£67 10/-	..
a	Potash, Chlorate	per lb.	2/6	..
a	" Perchlorate	"	2/-	..
a	Shellac	per cwt.	£22 10/-	..
a	Sulphate of Magnesia	per ton	£16	..
a	Sulphur, Sublimed Flowers ..	"	£35	..
a	" Lump	"	£35	..
a	Soda, Chlorate	per lb.	1/-	..
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c	" Tubes (solid drawn) ..	"	..	..
c	" Wire, basis	"	..	..
c	Copper Tubes (solid drawn) ..	"	1/7 to 1/7½	..
g	" Bars (best selected) ..	per ton	£147	..
g	" Sheet	"	£147	..
g	" Rod	"	£147	..
d	" (Electrolytic) Bars ..	"	£125	..
d	" " Sheets ..	"	£152	..
d	" " Wire Rods	"	£133	..
d	" " H.C. Wire	per lb.	1/3⅞	..
f	Ebonite Rod	"	8/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/3	..
h	Gutta-percha, fine	"	6/10	..
h	India-rubber, Para fine	"	2/10	2½d. inc.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£42	..
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e	" " " medium	"	8/6 to 6/-	..
e	" " " large ..	"	7/6 to 14/- & up.	..
d	Silicium Bronze Wire	per lb.	1/8½	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	..	..
n	" Wire, Nos. 1 to 16	per lb.	4/3	..

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

Electroplating Steel Springs.—One of the serious problems that confronts the makers and users of non-corrodible steel springs is the brittleness produced therein during electroplating, caused by the nascent or atomic hydrogen which is liberated at the cathode. The flexibility and elasticity of iron wire and steel springs are greatly decreased by pickling, and the effect is the more marked the thinner the material. Tin dipping before copper-plating is found to prevent embrittlement entirely. Steel springs may be dipped in molten tin at a temperature of 260° to 300° C. without appreciably changing their mechanical properties.—*Journal* of the Franklin Institute.

Coal in Algeria.—The recent discovery of beds of anthracite of considerable extent near Bona, in Algeria, has attracted the attention of the French Government, which has now taken over the working of the coal beds. The anthracite is stated to be equal to the best Cardiff coal, and can be sold at a price not higher than 150 lire a ton. Exported to Italy, its price would be about 210 lire per ton, and a first consignment of 30,000 tons will be ready to be shipped in two or three months. Many Italian thermal electric undertakings have been compelled to suspend working in consequence of inability to obtain imported coal, and the present opportunity is hailed with much satisfaction.

L.C.C. Tramway Requirements.—Owing to the difficulty experienced by many tramway undertakings in obtaining delivery of material from contractors, many of whom are bound to give preference to national work, tramway authorities frequently find it necessary to place emergency orders with firms with whom contracts have not been placed. The Board of Trade Tramways Committee has, therefore, proposed to the L.C.C. that it is necessary during present conditions that the practice of inviting tenders should be temporarily discontinued to enable orders for materials to be placed where delivery can best be made. After considering the matter, the L.C.C. Highways Committee proposes as an experiment until October 31st, 1918, that the practice of inviting tenders for six or twelve months' supply of tramway stores and equipment shall be discontinued, and that offers shall be obtained from time to time for the supply of goods, &c., required for the tramway department, subject to a limit of £250 in any one case.

NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

If the most economical results are to be obtained in the future, generation must be on a larger scale than it has been in the past, which necessarily implies the use of larger units of plant situated in positions specially selected, so as to reduce to a minimum the transport of fuel, and in order to obtain a sufficient supply of natural water for condensing purposes. To better understand these two important points, it may be worth while to consider what quantities are likely to be required.

Assuming a power station supplying a maximum load of 100,000 kw., which will certainly be required and possibly exceeded in some industrial districts, and a load factor of 57 per cent., the output will amount to approximately 500,000,000 units per annum. Exception may be taken to so high a load factor, but there is no doubt whatever that by pooling the output of a number of smaller power stations, thus improving the diversity factor, such a figure is well within the range of practical politics. Several undertakings already show load factors exceeding 30 per cent., and in a certain important district in the country a figure well over 60 per cent. is obtained.

With individual plant units of 15,000/20,000 kw., and fuel of 11,000 to 12,000 B.Th.U., the consumption should not exceed, and, in fact, should be rather less than 2 lb. per E.H.T. unit delivered to feeders. On the output mentioned, the coal consumption will amount to 450,000 tons per annum—say, 8,600 tons per week, or at a maximum rate of 1,550 tons per day, Monday to Friday inclusive, and considerably less on Saturdays and Sundays. This is equal to 150 to 200 wagons per day, or 15 to 20 wagons per hour on a 10-hour day. There should be no great difficulty in handling this amount, provided the sidings and bunkers are properly designed for the purpose. A far bigger problem is involved in the disposal of the ashes, which may be from 1,200 to 1,500 tons per week, and in selecting the site special consideration must be given to this point. It is extraordinary how quickly the large open spaces, valleys, or tips become filled up when used as a deposit for refuse from stations even of moderate size, and it is clear that the regular dumping of some 1,500 tons a week will effect a considerable change in the contour of the land in the immediate surroundings of a large power station.

The quantity of condenser water required will be six to seven million gallons per hour. This represents a stream having a minimum summer flow of water equal to 60 ft. wide and 4 ft. deep, moving at the rate of one mile per hour. The districts in this kingdom where a river exists capable of affording water to this extent can be counted on the fingers of two hands. The only alternatives are tidal waters or cooling towers, unless considerable structural costs are incurred in providing large reservoir accommodation in connection with rivers or streams having a less flow in summer and a greater flow in winter. The first alternative will in some cases prove a solution to the problem, particularly in localities where it is cheaper and more convenient to transport fuel by boat instead of by rail; but in a number of industrial districts situated within a reasonable distance of coal fields, cooling towers will have to be adopted wholly or in part by reason of the fact that they will be less costly in construction and more economical in operation than the provision and use of transmission lines between such districts and positions where natural water is available.

It is unfortunate, but nevertheless a fact, that many of the most important industrial districts are situated either where water is plentiful and collieries at a distance, or where coal is adjacent while an ample supply of water is almost, if not entirely, absent. The case of London may be taken to illustrate the first type of district—the Thames would provide sufficient water, but the nearest collieries are situated in the Midlands or in Kent, not less than 50 miles away. Birmingham, Sheffield, and Manchester have collieries within a convenient radius, but it is often necessary for them to obtain supplies from more distant sources; water in large quantities is not less than 50 miles distant. Apart altogether from what may be termed the economic question—*i.e.*, whether it will be cheaper to transport fuel into industrial centres or to transmit electrical energy to such centres from colliery districts—there is the larger question whether a large industrial community whose demand may reach and even exceed 500,000 kw. should be entirely dependent on long transmission lines for its daily transport, employment, and domestic requirements. I cannot conceive that a large City Council responsible for the supply of so important a commodity would be content to depend wholly on a distant power station.

Many of those who have read the Coal Conservation report have the impression that the Committee advocates the establishment of 16 super-stations to supply the whole of the country. This interpretation is clearly wrong. Taking the total demand as 10,000,000 H.P. for all purposes, this reading of the report would necessitate the setting-up of individual power stations dealing with a demand approaching 1,000,000 H.P., or, say, 750,000 kw., in certain dense industrial districts. Such a proposal would be entirely impracticable, considered from the coaling and condensation-water point of view. The intention as expressed is to divide the country into 16 districts for administration purposes, and each district authority, knowing the needs and the localities where power is required, will determine how many power stations are necessary and where they can be placed to the greatest advantage. In some cases it may be possible to supply the whole of a district from one power station, while in others five to ten may be wanted.

It will be of interest to consider what form of Central Government Authority should be set up by Parliament to exercise administrative powers in connection with the reorganisation of electricity supply on a national basis. An alteration in present methods is long overdue. The Board of Trade has far too many duties to perform, and should be relieved of its responsibilities in this matter. The capital expenditure at the present time on electricity supply undertakings is approximately £120,000,000, and the income derivable therefrom exceeds £20,000,000 per annum. Developments in the near future must inevitably lead to an increase in the expenditure to at least £500,000,000, from which an income of £100,000,000 may be expected.

The amount of capital involved, and the vital necessity of exercising economy in the use of fuel, so as to provide the cheapest possible supply of power for the benefit of industries, are surely of sufficient importance to justify the setting-up of a special Government Department to deal solely with such questions.

Irrespective of the form of authority which may hereafter be formed to exercise powers in each of the 16 districts, it is necessary that such a Department should be established to which would be transferred the duties in regard to electricity supply matters now exercised by the Board of Trade, the Local Government Board, and, to a less extent, the Home Office.

The State Department would probably have at its head a political Minister, not necessarily possessing any special technical or engineering qualifications, who would be responsible to Parliament. A permanent secretary would hold the chief executive office. As advisers there would be appointed several departmental heads consisting of experts on such matters as land and buildings, mechanical and electrical engineering, technical investigation, electric lighting legislation, and finance. They would, in fact, occupy much the same position as the Commissioners who have been advocated by various supply interests. The heads of the Departments would be paid such a salary as would attract really first-class men, and they would be absolutely debarred from being interested, or in any way associated, with industries allied to electrical manufacturing or supply. On this Department will depend the successful development of electricity undertakings and the satisfactory establishment of the manufacturing and allied trades whose progress is so intimately concerned in an increased use of electrical energy.

(To be continued.)

THE CONTROL OF LARGE AMOUNTS OF POWER.

By E. B. WEDMORE, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page 286.*)

APPENDICES.

Rupturing Capacity of Oil Switches.

Switches for any particular system must be rated to give satisfactory operation (1) under the severest emergency conditions, and (2) under normal service conditions. This requires the following:—

(*a*) They must break with certainty the maximum possible short-circuit they may be subjected to.

(*b*) The damage to the switch should be such as not to interfere with the commercial operation of the plant.

The second condition is the one which requires watching. For the usual conditions of electrical distribution it is quite sufficient if the switch will break the maximum short-circuit current twice, and after this be capable of carrying normal current.

For railway service and other heavy power service, where heavy short-circuits may be frequently met with, the switch will require to withstand the corresponding frequently-repeated shocks and destructive arcing, and must be rated accordingly.

Switches are obtainable able to cope with the severest conditions likely to be met with in this country for some time to come, and with a long record of good service behind them, giving the only possible non-speculative guarantee of their reliability under all manner of working conditions.

Switches have been employed in this country for many years past having great mechanical strength, chambers able to resist high explosive forces, high speed of break, and suitable contact design. These and other features all serve to give high rupturing capacity.

The designer's data are still largely empirical, and there are many ideas in circulation in the nature of half truths, such, for example, as that switches should be compared by comparing the length of break.

The above features in design are being incorporated in an increasing degree in switches of small size, with the intention of increasing the rupturing capacity without increase of dimensions and without much increase of cost. There has been no radical departure in the design of oil switches in recent years, and, until we have some important discovery to help us, switches will remain pretty much as they are now. Rupturing capacity and cost of switchgear equipments vary roughly in simple proportion.

A switch may be suitably rated for 1,000 amperes and 6,000 volts, and yet may be quite unsuitable for use on a 500-volt circuit where it is called upon to make circuit on several hundred amperes several times a day.

Switches for industrial use, if well designed, have a rupturing capacity of 5,000 to 15,000 k.v.a. Switches for consumers' premises and sub-stations will rupture about 10,000 to 35,000 k.v.a., according to size. Next there are lines of switches rated in the neighbourhood of 100,000 to 200,000 k.v.a., suitable for stations up to 30,000 k.v.a., and for large sub-stations on much larger plants.

Rating of Reactances.

In discussing the use and characteristics of reactances it is most convenient to rate them in terms of the percentage reactive voltage drop they will give on the full-load rating on the part of the plant with which they are associated.

In the case of bus-bar reactances, each reactance is associated with a section of the bus-bar, and should be rated on the total generator capacity attached to the section.

A feeder reactance may be rated at 3 per cent. when associated with the feeder, but if its effect on short-circuit is considered in connection with a generating plant of 10 times the feeder rating, it at once becomes 30 per cent. When rated in this way it may be added to the reactance of the generators expressed in the same terms. This method of rating enables the employment of reactances to be discussed in general terms and without reference to the size and voltage of the plant.

The individual reactance is best rated in amperes, carrying capacity, and ohms reactance at a given frequency, with the addition of working voltage, which determines the insulation required.

Arrangement of Bus-bars.

In the provision of bus-bars and switches, something more is required than a simple straight bus-bar, or even a single ring bus-bar with one switch per circuit. Additions are made both to give duplication for safety and to provide flexibility.

The first essential is a spare bus-bar arranged so that any section can be shut down without interfering with supply. In the matter of switches it is recommended that all normal switching operations should be done by means of oil switches, and that air-break switches should be used only for isolating parts already made dead by oil switches. By this course adequate duplication is provided, and the risk of serious trouble due to operator's mistakes in routine work is reduced to a minimum.

If oil switches are not duplicated, the fact of an oil switch being put out of commission for any reason prevents the corresponding machine or feeder being employed, and thus must lead in the long run to greater expenditure on spare plant or a greater risk of serious lack of spares on emergency.

Bus-bar reactances may be employed in either of two ways, conveniently described as the star and ring designs.

In the star design the bus-bar reactances are paralleled by tying them to a common point or tie bus-bar, whilst in the ring design each bus-bar section is tied to the next through a reactance (fig. 4).

With the star arrangement, whatever sections are employed are paralleled by the simple operation of coupling them to the tie bus-bar, whereas in the ring arrangement it is not possible to maintain the ring formation when one section is shut down, or easy to follow the load-transfer conditions, and mistakes are more easily made.

In many situations it is easier to make a good design with two bus-bars than with three, so that there is a use for the ring arrangement. The ring arrangement, however, has the defect that under working conditions the ring cannot always be maintained closed. The balance of advantage lies with the star design.

Current-limiting by the Use of Bus-bar Reactance.

Using the short-circuit current obtainable without bus-bar reactance as a unit, figs. 6 and 8 show the reduction obtained with different values of bus-bar reactance "B" expressed in terms of the generator reactance "A" and for different numbers of bus-bar sections. In fig. 6 from the bottom of the diagram it is evident that the introduction of a small amount of bus-bar reactance has a big effect in reducing the short-circuit values. As the reactance value is increased its effectiveness by no means increases proportionally. The same is true of increasing the number of sections.

The results are shown in a different form in fig. 8, the horizontal ordinates in which are the inverse of those in fig. 6

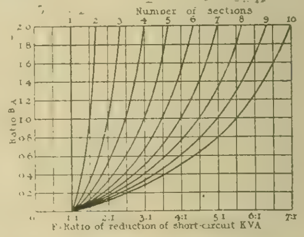

Fig. 8.—Reduction of Short-circuit k.v.a. with Star Design.

These curves cover the ground of what is practicable. The amount of bus-bar reactance permissible is limited by the permissible voltage difference between bus-bar sections, and in the endeavour to keep down short-circuit stresses the increase of generator reactance will keep down the ratio well within the range of the above curves and within economical limits.

So long as the generator reactance can be provided internally the cheapest combination will be that with minimum bus-bar reactance, but even if all necessary protection of plant could be obtained with generator reactance alone, it would still pay to employ bus-bar reactance owing to the protection afforded to continuity of supply.

Design of Current-limiting Reactances.

The special feature of reactances employed for current-limiting is that the current they have to limit on emergency is many times the maximum current they may have to carry continuously.

There is no gain in the use of iron in the design, as in order to ensure the correct reactance under heavy currents the iron has to be worked at very low densities under normal running. There are other good reasons for avoiding its use. There are great and obvious advantages in employing a design in which all parts are fully open to inspection, and this is impossible where iron is employed.

Fig. 9 illustrates a reactance designed for this class of service, and shows how readily all parts can be inspected. The coils are of bare copper, so there is no insulating material to give trouble. The only high-tension insulators are the very substantial ones forming the feet on which the reactance stands.

A reactance of this kind installed in a brick chamber cannot break down to earth, as there is no good earth in the neighbourhood

Heating and Stresses due to Heavy Currents.

With adjacent conductors at 12-in. centres carrying current in opposite directions, the maximum repulsive force between them will be 9 lb. per foot run for 10,000 amperes. R.M.S. value. The force varies inversely as the distance and proportionally to the square of the current, and often attains serious proportions in modern practice.

In a three-phase cable carrying 100,000 amperes on a fault the force may reach a maximum of 12,000 lb. per foot run, and would approach this in the joint boxes. Conductors spaced 1 ft. apart will be subjected to 900 lb. per foot run on the same current. Current transformers should not be subjected to more than 200 times normal load current.

A 300-ampere isolating switch of the type shown in fig. 10, or an oil switch of the type shown in fig. 11, with insulators at 10-in. centres, may have a force of 100 lb. distributed over the blade on a current of 20,000 amperes, or 600 lb. for 50,000 amperes. If the switch be designed as in fig. 12, the conductors will be almost in line with the blade, and the force due to the loop formation will be relatively negligible.

It is good practice to lock or latch the blades of all back-connected isolating switches on 6,000-volt plants where the output may reach 10,000 K.V.A. or upwards, and to latch all switches where the output may exceed 20,000 K.V.A. These figures are typical of what is required.

In conductors for alternating-current circuits above 2,000 amperes capacity "skin effect" has to be seriously considered. So long as the total thickness of the copper in the several laminations added together does not exceed 1¼ in., skin effect does not become serious, but above this figure it rapidly becomes a most important factor.

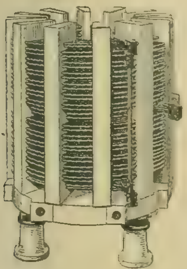

Fig. 9.—Current-limiting Reactance.

Fig. 1.—Portion of the New Ironclad Switch Machine Shop at the Witton Works of the General Electric Co., Ltd.

A copper bus-bar 10 ft. long and 2 sq. in. cross-section, able to carry, say, 2,000 amperes, will exert a theoretical maximum pressure of about 15 tons for a total temperature change, due to electric heating and atmospheric conditions, of 60 deg. C. The same bar for the same temperature change will increase in length by about ½ in. This can be absorbed by deflecting the bar about an inch at the centre if it is free to move, or by the slipping of the bar on its supports. Expansion is generally taken care of by slipping. It is, however, good practice on long bus-bars to limit this by the use of expansion joints.

If heat is generated in a conductor very rapidly there is no time for radiation, convection, and conduction to play their part. Currents flowing in copper conductors at 1,000 amperes per square inch will raise the temperature 50 deg. C. per hour if the heat is all absorbed. On this basis a current of 100,000 amperes, say, 1,000,000 K.V.A. on 6,000 volts, will raise the temperature of a 0.1 sq. in. cable at the initial rate of about 12,500 deg. C. per second.

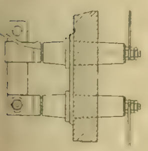

Fig. 10.

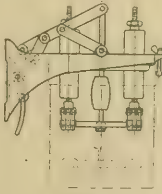

Fig. 11.

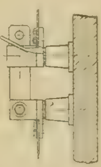

Fig. 12.

Fig. 10.—Typical Isolating Switch Subject to Large Forces.
Fig. 11.—Typical Oil Switch.
Fig. 12.—Typical Isolating Switch Subject to Small Forces.

The effect of the initial rise is to raise the resistance of the copper conductors, the specific heat remaining steady so that the rate of rise is accelerated as it proceeds.

The serious overheating of a conductor in a cable may damage the cable from end to end.

Experience with stations designed in recent years, and having a maximum short-circuit current of 10 times their normal rated output, has shown that it is necessary that the smallest current transformer on the main switchboard should have a carrying capacity not less than one-twentieth the station output. Current transformers of good design and much smaller than this have been exploded by the heat generated on a short-circuit.

THE NEW IRONCLAD-SWITCH DEPARTMENT AT WITTON.

In the report of the Coal Conservation Sub-Committee of the Reconstruction Committee it is stated that 95 per cent. of the factories erected for war purposes since August, 1914, use electric power. This fact is an index to the enormous demand which the war has created for electrical plant and accessories. No limit was placed on the output demanded from manufacturers of generators, motors, switchgear, transformers, and every other class of standard product. In the case of the switch department at Witton, the space available soon became congested by the continuously increasing pressure of orders. At the beginning of 1916 it became apparent that the capacity of the department would need to be at least doubled if the output were to be maintained within reasonable distance of the most urgent demands. Various

Fig. 2.—Fitting Shop, showing on the right the Transporter Tables by means of which the Assembled Switches are conveyed to the Test Panel.

plans for extensions were considered, but they had to be put aside owing to the lack of materials and labour for building operations. Eventually it was decided to make use of space which had become available in the central stores, as a result of stock reductions caused by abnormal war conditions. One-half of the top floor of the building was cleared and fitted up for the manufacture of ironclad switchgear. In spite of inevitable delay in securing the delivery of tools, the new shop proved capable, within a few months, of achieving the 100 per cent. increase in output for which it had been designed. A still further increase has since been attained.

The total space occupied by the ironclad switchgear shop is close on 7,900 sq. ft. More than half of the space is absorbed by the machine shop (1,645 sq. ft.), the fitting shop (2,280 sq. ft.), and the machined castings stores (1,095 sq. ft.), and the remainder is divided up between the assembly room (710 sq. ft.), the component stores (839 sq. ft.), the rough castings stores (826 sq. ft.), and the final inspection and paint-drying section (480 sq. ft.).

The whole of the machine shop is devoted to the special machining—and the special machining only—of ironclad switches. Various parts which are in general use for electrical work—such as standard bobbin fuse-holders, contact clips, and so on—are made in the general works. All the machinery is driven by "Witton" motors, the group system having been adopted as most economical for banks of similar machine tools operating continuously.

In the fitting shop, which is a wide bay arranged with transverse benches, the switches are put together ready for testing and painting. When the switches are completed they are placed on transporter tables, and carried by means of under-trucks to the test panel. After being tested at high voltage they pass on to a turntable in front of the compressed-air paint spray, which gives them an even coat of paint with an excellent finish in a much shorter time than is possible with a hand-brush. The switches then move to an open space for drying purposes, and finally to the packing department. Thus, from the time they are fitted up and put on the transporting table, they are never lifted. This arrangement is not only of the greatest value in securing rapidity of production, but it is practically essential in view of the fact that all of the work is done at present by women, who would find great difficulty in lifting the switches.

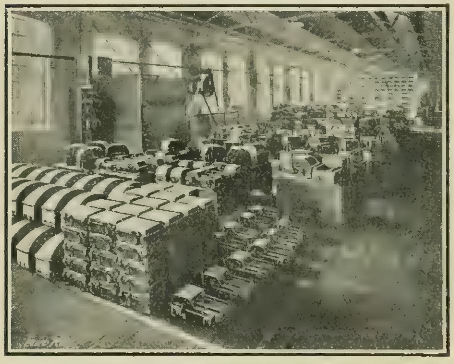

Fig. 3.—Portion of the Assembly Shop for Ironclad Switches at Witton. The High-voltage Test Panel and the Paint-spray Turntable are visible in the centre, and the Stores in the background.

The transporter arrangement is as simple as it is effective. It consists of a truck and a number of wooden platforms. The truck has two frames, a lower and an upper one, which can be altered in height by means of a lever. Close to each machine or bench is placed a platform, on which the goods are loaded as they are finished. When the load is complete, the truck is brought under the platform, and the upper frame raised so as to lift the platform clear of the ground. The load is then wheeled away, and another platform placed in position for loading up.

The assembling shop and the stores are also laid out with a direct view to facilitating a large and speedy output. Squares are marked out on the floor of the assembly shop, so that the various parts can be conveniently arranged in groups before being taken to the fitting shop. The stores are constructed with four large double racks of bins, and each size of switch is allocated to a pre-arranged portion of the bins. At the end of the larger racks there are smaller ones for the reception of the smaller parts, each size being stocked separately. This subdivision, and the close proximity of the stores to both the assembly room and the fitting shop—all departments being on the same floor—reduce delays to a minimum, and enable the various steps in the process of construction to be co-ordinated with ease and efficiency.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

4,215. "Searchlights." H. Munro. March 11th.

4,275. "Electric condensers." W. Dubilier. March 11th. (U.S.A., January 16th.)

4,329. "Receiving apparatus for wireless telegraphy." E. R. Clarke. March 12th.

4,333. "Inductively untappable telegraph." A. H. Morse. March 12th.

4,334. "Holders for electrodes of electric furnaces." J. R. Hoyle. March 12th.

4,336/7. "Electric contact-making and breaking apparatus." British Thomson-Houston Co. & A. P. Young. March 12th.

4,353. "High-tension fuse." A. Nielsen. March 12th. (Norway, April 12th, 1917.)

4,366. "Magnetos." G. A. Chailley. March 12th. (France, December 29th, 1917.)

4,373. "Coin-collecting means for telephone systems." F. W. Hall. March 12th.

4,374. "Dies for shaping insulators, &c." H. O. Busch-Jensen. March 12th.

4,397. "Apparatus for demonstrating systems of electric wiring." D. Rowan. March 13th.

4,404. "Electric generators." H. Shaw. March 13th.

4,419. "Electric switches." Siemens Schuckertwerke. March 13th. (Germany, January 20th, 1917.)

4,428. "Control of electric furnaces." W. J. Howard. March 13th.

4,460. "Ignition system for internal-combustion motors." H. Royer. March 13th. (France, January 16th, 1917.)

4,498. "Housing adjusting and locking nut for electric motor horn." J. W. Monk. March 13th.

4,527. "Mounting of electrodes of electric furnaces." C. C. Gow. March 14th.

4,529. "Electric accumulators." W. H. Exley & H. Leitner. March 14th.

4,530. "Manufacture of electric accumulators." W. H. Exley & H. Leitner. March 14th.

4,553. "Controllers for alternating-current motors." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 14th.

4,556. "Signalling and navigation lamps, and switching devices therefor." A. H. Morse. March 14th.

4,582. "Telephone instruments for observation stations." British L. M. Ericsson Manufacturing Co., A. Brookes & G. Larsson. March 15th.

4,609. "Manufacture of commutators." McKenzie Holland & Westinghouse Power Signal Co. March 15th. (U.S.A., March 16th, 1917.)

4,613. "Apparatus for therapeutic treatment by electric and other forms of radiant energy." W. J. Smyth. March 15th.

4,640. "Electric motor controllers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 15th.

4,652. "Method of supporting overhead wires of electric tramways and railways." S. T. Quilliam. March 16th.

4,659. "Manufacture of bowls or shades for electric lights." J. W. Barnett. March 16th.

4,680. "Ignition systems for internal-combustion engines." C. F. Kettering. March 16th. (U.S.A., August 30th, 1915.)

4,689. "Electric cells or batteries." E. Baur & W. D. Treadwell. March 16th.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

2,179. Electric Torch. S. D. Williams. February 14th, 1917. (113,313.)

2,296. Telegraph Apparatus. Indo-European Telegraph Co. & A. H. Morse. February 15th, 1917. (113,317.)

2,228. Method of Manufacturing Electrically-welded Rims from Metal Strips with Upturned Edges. R. Kronenberg. February 14th, 1917. (113,444.)

2,398. Manufacture of Multi-cell Electric Batteries. A. V. St. Armande. February 17th, 1917. (113,469.)

2,488. Electric Motor-control Systems. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 20th, 1917. (113,473.)

2,570. Automatic Control of Electric Generating Sets for Emergency or Stand-by Purposes for Ships, Public Buildings, and for other purposes. G. C. Pillinger & L. Sunderland. February 21st, 1917. (113,479.)

2,574. Mounting of the Cams of Interruptors for use in the Ignition of Internal-combustion Engines. H. de la Valette. February 25th, 1916. (104,870.)

2,600. Means for Rendering Liquids Radio-active. O. A. Elias. February 22nd, 1917. (113,483.)

2,691. Controllers for Electric Circuits. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 23rd, 1917. (113,332.)

2,895. Ignition Systems for Internal-combustion Engines. Philips Brinton Co. March 23rd, 1916. (105,327.)

2,991. Spark Plugs. A. L. Riggs. February 28th, 1917. (113,495.)

2,994. Electric Incandescent Lamps. F. M. A. Wybaillie & A. Peyman. February 28th, 1917. (113,496.)

3,039. Wireless Radio-signalling by the Arc System. L. Cohen. March 1st, 1917. (113,498.)

3,128. Electromagnetic Switches or Contactors. F. N. Pickett and Allen, West & Co. March 2nd, 1917. (113,502.)

3,290. Electric Controlling of the Locks of Lockers and the like in Factories, Munition Works, and such like places. A. A. Grant. March 6th, 1917. (113,344.)

3,258. Miners' and like Electric Safety Lamps. O. Oldham. March 5th, 1917. (113,506.)

3,285. Electrochemical Process for the Treatment of Metallic Ores. C. O. Griffith. March 6th, 1917. (113,508.)

3,295. Systems of Control for Electric Motors. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 6th, 1917. (113,509.)

3,610. Electric Switch Boxes. W. T. Henley's Telegraph Works Co. and E. Moor. March 12th, 1917. (113,350.)

3,807. Electric Batteries. Svenska Accumulator Aktiebolaget Jungner. August 8th, 1916. (108,849.)

4,036. Fusible Cut-outs. E. S. Conradi & J. F. Conradi. March 20th, 1917. (Patent of addition not granted.) (113,518.)

4,202. Globes for Enclosing Electric Glow Lamps. Veritys, Ltd., and T. l'Ons. March 23rd, 1917. (113,519.)

4,225. Railway Signalling Apparatus. S. P. Wood & McKenzie and Holland. March 23rd, 1917. (113,520.)

4,479. Switch Apparatus for use with Electric Pocket Lamps, Electric Torches, and other Electric Lamps, which carry their own Cells or Batteries. Efandem Co. & A. H. Williams. March 28th, 1917. (113,526.)

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PROBLEMS OF MOBILISATION AND DEMOBILISATION.

THE very determined effort of the enemy to effect the destruction of the British Army was followed by such results in the early stages of the attack that we are now faced once again with the necessity for raising more men, and for expediting the production of certain classes of munitions. The situation has apparently disposed of the threatened trouble among certain sections of the engineering workers who objected to the Government combing-out conditions; the young miners are reported to be enlisting against the vote of their organisations; and the invitation to men "up to fifty" to offer their services is stated to have met with a satisfactory response. There is a good deal of discussion proceeding in the daily Press, as at previous stages of the war, concerning other measures which Parliament may adopt when it reassembles next week for strengthening the forces. Possibly before these lines appear in print some authoritative forecast of policy will have been made so as to prepare the nation for what lies before it. Speaking generally, the question of man-power as a whole is hardly within our province, but we cannot forbear to remark that if the war comes to a conclusion without the young manhood of Ireland having been conscripted it will stand on the records to her eternal disgrace, and as one of the most disagreeable spots in the history of the war. The appeal of the situation, backed up by the appeal of the Ministry of Munitions, to the workers engaged on certain lines of war requirements to forgo their Easter holidays met with so enthusiastic a response that we see that when once the seriousness of the situation is really understood, the nation in general stands solid in its determination to back up the Forces at whatever sacrifice.

The state of the war lessens very considerably one's desire to discuss matters affecting after-the-war. For several weeks past we have had before us a number of documents respecting such questions, and it was our intention to deal with them this week, but we confess to a feeling of indisposition to do so. Yet, though new mobilisation measures have become necessary, thus rendering still more difficult the problems of demobilisation and after-war relationships, we must not ignore the fact that demobilisation is already and always taking place, and that after-war relationships are in that sense being formed. In addition, there has to be remembered the possibility, we dare not say probability, for we are not yet able to judge, that the very extent of the enemy operations at the moment may bring nearer than would otherwise have been the case the day when demobilisation on the large scale may be the task in hand. In these critical days when, as some suggest, the situation may change favourably for us in such a way as to hasten the end, we are more inclined to let all our thoughts, energies, and prayers out in a flood in support of our optimistic fighting sons and brothers and to leave the rest; yet the need for some amongst us to be preparing the ground for those who will return in due course is as great as ever, indeed is resting upon us as a duty that we do well to perform as a huge debt to be discharged. Therefore, we welcome the documents that are before us concerning the big campaign upon which the National Alliance of Employers and Employed has entered for the establishment of joint committees of masters and men in many centres.

It is the policy of the Alliance to secure that representatives of Capital and Labour shall jointly work out the lines on which the problems of the days to come shall be solved and the future relationships of the two parties established. Its programme embraces factory and workshop conditions, also such matters as housing and education, its aim being that everything that affects not only industry as such but the everyday lives of the workers, shall be a question for the consideration of its Joint Committees. Such Committees, we understand, are already at work in many centres, and the present campaign is designed to establish them in every district. One of the beliefs of the body of commercial authorities and trade-union leaders who form the executive of the Alliance is that those who are directly concerned in industry are better able to reconstruct that industry than any State Department. Reconstruction will be facilitated by industrial harmony if it exist, but the existence of industrial harmony is largely dependent upon the spirit and character of reconstruction measures. As we have shown fairly fully during recent months, the Ministry of Reconstruction and the Ministry of Labour have their elaborated schemes respecting demobilisation, industrial control, and so forth. It would have been a crime on the part of the Government if all aspects of such huge problems, affecting directly or indirectly the entire nation, had not been most exhaustively studied, however many committees were required for the purpose, but what emerges from these investigations will have to take shape in the form of legislative enactments, and Parliament will have to discuss and approve or disapprove them. It has been explained that the hand of State control cannot be withdrawn in a hurry, or disaster will ensue. The Government spokesmen that we have listened to have disowned any desire on the part of the State to control or interfere one moment longer than is necessary in the best interests of the nation. They have also shown very emphatically that the date of control withdrawal will depend upon the ability of industry to control itself. The unfettering of industry is one of the great essentials for full progressive development back to the normal, and the organisation of the industries is of the first importance to that end. This was stated with absolute clearness by representative leaders at the recent Guildhall Industrial Reconstruction meeting. We hope that the efforts of the Alliance to set up these local joint committees in all parts of the country will prove to be a means for expediting that work of organisation, and ensuring the co-operation of employers and employed with a minimum of interference by the State.

Rations and Fuel Economy. One does not usually look to the *Daily Mail* for inspiration on such a prosaic matter as fuel economy, but the subject has recently attracted the cursory attention of the gentleman responsible for the financial comment in that journal, who expresses the opinion that the proposals for economy in the use of coal and electricity create special interest in the financial results of the London electricity undertakings during the past year. His interest takes the form of a table showing the net revenue returns of a dozen London undertakings for the past and two previous years, and, after remarking that "many companies have increased dividends," he enigmatically states that "there is obviously room for economy." It *is* interesting to note that the net revenue returns of these twelve companies for the past year show an increase in the aggregate of 6 per cent. on those of the previous year, and of 5.2 per cent. on those of two years ago, which represents on the whole only a fractionally increased return on the money invested in these undertakings. We do not suppose that the *Daily Mail* will cavil at this, under present conditions especially, but apparently the inference is drawn that an increased net revenue necessarily implies an increased output of electricity, and that the latter involves the use of coal or fuel which would not otherwise be used. Neither of these inferences is really justified; with the increased prices for electricity, a higher net revenue might result from a smaller output of electricity; and experience in other directions, where lighting has been curtailed, has shown a comparatively small reduction in fuel used, where boilers have to be kept under steam in any case.

However, the rationing of electricity and gas applies mainly to large consumers—such as, for instance, the *Daily Mail* and its associated newspapers —and without expressing any opinion as to whether they are in a position to economise or not, we can safely affirm that the increased use of electricity (and gas) is the bedrock foundation of fuel economy proposals at the present time. In this connection, attention may be drawn to the remarks of the chairman at the meeting of the City of London Electric Lighting Co., Ltd., reported in our "City Notes" to-day.

With regard to the Board of Trade Order of March 26th, restricting the consumption of gas and electricity by private consumers in the South of England (except those taking very small quantities) to five-sixths of their consumption in the corresponding quarters of 1916 or 1917, "whichever was the greater," while this condition will be easily complied with by many consumers, it will press hardly upon the many others who reduced their consumption to the minimum before 1916, and have left themselves no margin for further economy. It has been brought to the notice of the Board of Trade that in this respect the Order is unfair, discriminating in effect against those who have practised economy in the past, but nevertheless the Order has been put in force. One result which we anticipate as a possible outcome of this condition is an increased use of coal for domestic purposes; for a large proportion of gas, and an increasing amount of electricity, is at present used for cooking and heating, and the most obvious method of reducing the consumption of these commodities is to cook with coal fires—the supply of coal available under the rationing scheme being ample for this purpose. We wish to point out that so far as this result occurs, it will entail an increased consumption of fuel on balance, which is precisely the opposite effect to that desired by the Government, for there is no doubt that cooking and heating by gas and electricity involve a smaller consumption of fuel than the direct use of coal.

It may be that such cases will be in the minority, and that *on the whole* an economy of fuel in domestic establishments will be effected; the curtailment of shop-window lighting and the early closing order for places of entertainment and refreshment will certainly have that result, and thus the Order may appear to have achieved its purpose. It must also be admitted that while the present Order will impose a considerable amount of labour upon the clerical staffs of gas and electricity supply undertakers, it would be a far greater task to draw up a schedule of rations for individual consumers based upon the number of persons on the premises or the number of rooms occupied, even though the data necessary for this purpose are already filed in connection with the food and coal rations. Nevertheless, leaving apart the question of labour, it cannot be seriously denied that the system of rationing adopted in this case is fundamentally unsound and unfair, and, while it may serve in the present emergency, it most certainly ought to be superseded by an equitable and logical system at the earliest opportunity.

British Electrical Engineers.

While station engineers are still struggling with the problem of organising, upon the old A.E.S.E. as a foundation, a new association of station engineers and charge engineers generally, known as the "Electrical Power Engineers' Association," of which local branches are already in existence, and which is carrying on an active campaign in the Provinces to secure additional members, we learn that still another proposal has been formulated, contemplating the formation of an "Association of British Electrical Engineers." Some particulars as to the ideas and intentions of the promoters of this movement are given in our "Notes" columns to-day, from which it will be seen that it has been launched with the unofficial, but undisguised, support of some of the most influential bodies connected with the electrical industries—notably the Institution of Electrical Engineers and the Incorporated Municipal Electrical Association—as well as by smaller societies more directly associated with central-station work. The project is still in embryo, but is assuming practical shape, and will shortly come before the electrical public for open discussion; in the first instance, the formation of the "Electricity Supply Section" is proposed, implying that the scheme as a whole will ultimately include other sections of the industry, as and when the occasion arises for their formation.

The question will naturally be asked: What will be the relations of this new body to existing societies with similar objects? From inquiries that we have made, we understand that its attitude will be wholly friendly and beneficent towards all of them. Its purpose is purely protective—"To safeguard the interests of all professional and technical men" in the electrical industries; it is somewhat akin to the British Medical Association, and is, of course, in no sense a "trade union." It appears to embody the proposal which has been urged at meetings in connection with the reorganisation of the A.E.S.E.—namely, that the initiative should come, not from the junior members of station staffs, but from the seniors; it may be regretted that action was not taken by them earlier, in view of the vigorous efforts that have been made by the juniors to organise themselves, which might then have been directed towards the development of the B.E.E.; but we trust that the work that has been accomplished by them will in the end prove fruitful, for the successful establishment of the B.E.E., supported as it is by such powerful forces, can hardly be doubted, and it will clearly be in the interest of the minor associations to affiliate themselves to or merge themselves in the new body. The latter, we understand, has no desire to interfere with the former; its aims are simple and broad-minded, and in that light we welcome the proposal, and commend it to the favourable notice of our central-station readers.

American Water Power.

The United States is hastening forward with special legislation for facilitating the greater use of water power. Our American exchanges just to hand contain particulars of plans for "quick action," and advice from Secretary of War Baker and other State Secretaries urging all possible haste upon the Committee which is dealing with the matter. The joint advice of the Secretaries sets forth that the water-power problem is one of the most important matters for the consideration of Congress on account of the conditions now affecting the power supply industry, and the need for maintaining the entire industrial machinery at its highest efficiency. It is added:—

> The industrial expansion which has been necessary in order to produce the materials and equipment needed in the prosecution of the war has placed unprecedented demands upon the electric power industry to such an extent that the output of commercial central stations has increased more than 60 per cent. since 1914. This increase has been greatest in the manufacturing sections of the East, where water-power development is comparatively limited, and has been chiefly in the form of steam-generated power, because steam power can be developed more quickly, and at less capital cost than water power.
>
> There is also need of legislation in order that time may be given to prepare for the developments that must take place after the close of the war if the United States is to maintain its proper place in world trade, or even to supply its domestic needs. A survey of our water-power resources is needed, particularly with relation to specific districts and specific industries.

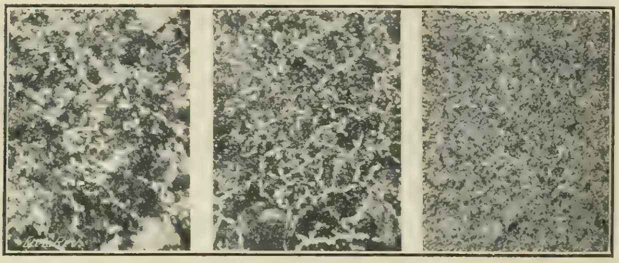
It is suggested that there should be a co-ordination through a single agency of all the Federal Government establishments which have to do with the administration of water power, and that, as far as practicable, all agencies, Federal, State, and private, should be brought into co-operation. A Federal Power Commission, with ample authority to undertake preliminary investigations, is recommended in a Bill that is now before Congress. It is not only the need for power development that has led to this movement, but the need of increasing the proportion of water power, and reducing the drain on coal and (particularly) petroleum supplies, as well as lessening the demands upon labour and transportation. The latter demands alone are regarded as sufficient reason for substituting water power for steam power wherever possible.

Supply Works in Invaded Districts.

The French Minister of Public Works has requested the chief engineers of the Ponts et Chaussées in all Departments to examine a programme for utilising the hydraulic powers belonging to or under the control of the State. On the other hand, the supply companies whose works are situated in enemy-occupied districts have approached the Government in regard to the resumption of activity as soon as circumstances will permit. Under the auspices of the Syndicat des Producteurs et Distributeurs d'Energie Electrique the various companies have met and submitted to the authorities a scheme for the restoration of the works and the networks of mains. According to a statement recently made at the annual meeting of the Electricité et Gaz du Nord, the authorities appear disposed in principle to grant certain financial facilities in such a manner that the companies concerned will not be compelled to await the evacuation of the invaded territory before they will be able to provide plant and machinery in substitution for those removed by the enemy. It appears that two or three stations are still in operation in the region concerned.

THE SANDBERG TREATMENT OF TRAMWAY RAILS.

The name of Sandberg has been closely connected with tramway practice during the last few years—first, by reason of its association with silicon rails, which have been successfully employed on many tramway systems throughout the world, and, later, by the development of sorbitic steel, which is of great interest to all users of rails, whether for tramways or railway purposes. The value of the Sandberg treatment, which produces a sorbitic structure, can be realised only in the case of new rails, and as new rails are to-day practically unprocurable, the use of the true sorbitic rail, so far as tramways are concerned, must necessarily be deferred until rails are available.



Normal State. Intermediate. Hardened.

Fig. 1.—Photo-micrographs of a Steel Tramway Rail.

In the meantime, the deterioration of permanent way on tramways is continuing at a very rapid rate, and the attention of the Board of Trade is being seriously directed to means by which the most important tramway systems in the country can be maintained in such a condition as to continue to give a reasonable service.

Having regard, therefore, to the conditions which at present prevail, any method or process which will prolong the life of the track must be of great importance, not only from the point of view of individual tramways, but more especially from the national standpoint.

A development of great interest in the treatment of rails is that which has recently been devised by Mr. C. P. Sandberg, and which consists in the hardening of rails *in situ*. It is, perhaps, a somewhat daring innovation to treat rails lying in the ground, because any method of hardening involves some form of heat treatment. The process, which is patented, has been carefully developed until it can be claimed to be a practical working proposition. While experimental work has been carried on for some time on the Leeds tramways and elsewhere, the application of the Sandberg treatment *in situ* at Croydon is the first application under working conditions, and we had the pleasure of inspecting it on Tuesday, March 26th, when tests and specimens of treated rails were shown which appeared to prove all the claims made for the process.

Obviously, the invention must necessarily include means by which the treatment of the rail is done progressively. The patent claims the hardening or tempering of the head or surfaces of rails, switches, and points of crossings, by heating them in continuous succession, and subsequently quenching or cooling them moderately quickly, in order to produce the hardness or temper desired. The method of accomplishing this consists in causing a flame, or flames, to move slowly along the surface of the rail, and this is what has been done on the Croydon Corporation tramways.

Mr. E. F. Morgan, the borough road surveyor of Croydon, after investigation into the Sandberg system of treatment *in situ*, decided to apply the method to a portion of the tramway rails, and the work of hardening the rails, as well as joints, has now been carried on for some time past.

While the treatment constitutes a striking departure from existing practice, the method of application is a good deal simpler than might at first be thought possible. The application of a somewhat intense heat to the surface of a tramway rail might give rise to doubt as to what effect the heat would have on the surrounding pavement, for it has to be borne in mind that the treatment is carried out without any disturbance whatever of the permanent way. It was at first thought desirable to protect the pavement against the flame, but experience showed that it was not even necessary to provide any form of protection, for the reason that the heat is too local to cause any damage to the surrounding pavement.

From the photo-micrographs which have been obtained of the Croydon rails, of which examples are given in figs. 1 and 3, the hardening is carried out to a quite considerable depth—about $\frac{1}{4}$ in., and the ideal aimed at is a depth of about $\frac{3}{8}$ in. on the inside edge, diminishing to zero on the outside edge of the rail. Obviously, if the heat treatment can produce a hard head, it is bound to result in a considerable increase in the life of the rail, and the wear must be in consequence greatly retarded.

In addition to treating the whole length of rail in order to retard wear, there are many cases where the most serious trouble on tramway permanent way arises at the joints; in other words, the rail, generally speaking, will attain a fairly long life without any hardening treatment, but the battering of the joints which is set up by the deterioration of the permanent way at these points has such effect on the rail ends as either to make the rail useless or to render it necessary to cut the rails at the ends and insert new short lengths.

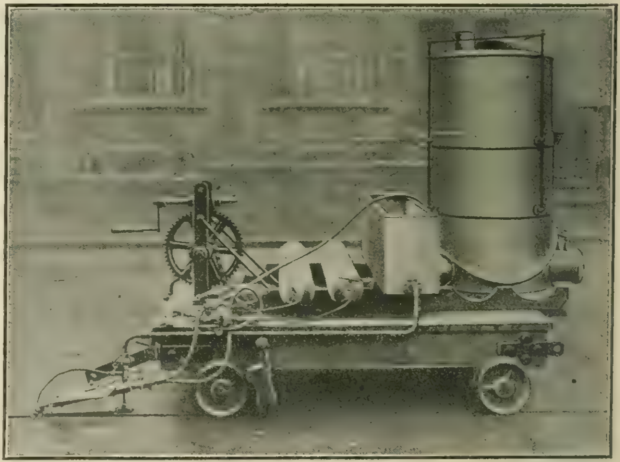


Fig. 2.—The Sandberg Oxy-acetylene Apparatus for Tramway Rail Treatment.

It is under conditions of battering that the Sandberg treatment has proved to be remarkably efficacious. While it does not stop the knocking at the joints, the system can be used to harden the rail ends to such an extent that the effect of battering is very much reduced. It has been found at Croydon that the treatment of the rail ends has produced hardening to a very marked degree, and while the photo-micrographs demonstrate this very clearly, there is ocular evidence that a change in structure has taken place, because after a short period the rail ends when treated become highly polished, and have a striking resemblance to the polish obtained on manganese points.

The treatment of the rails at Croydon is accomplished by means of a special travelling truck, on which is mounted the apparatus to provide means of heating as well as cooling. The source of heat is an oxy-acetylene flame, the acetylene generator and oxygen cylinders being carried on the truck, as shown in the illustration, fig. 2; a tank is also provided to furnish water for cooling. By means of a geared hand-wheel the truck can be moved at a certain definite rate.

The truck is the first of its type, and those that are now being designed are larger, and will include modifications which will increase the efficiency of the plant.

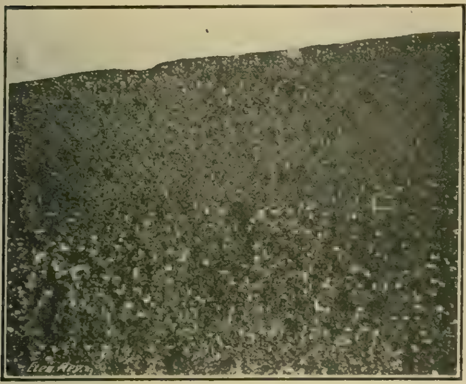


Fig. 3.—Fracture, Magnified Five Times, Showing Depth of Hardening.

While oxy-acetylene is used in the case of the Croydon treatment, it is, of course, possible to use other means of heating.

The speed at which the treatment is applied at present with this first type of truck is about 1 ft. per minute, but there would be no difficulty in greatly increasing this speed by the adoption of multiple burners and trucks, and a considerable saving in both material and labour should be effected by the development and use of this treatment.

NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

(Continued from page 309.)

One of the most important matters influencing the cost of supplying any commodity is the terms on which capital can be raised for the purpose of providing the manufacturing equipment. Under pre-war conditions the annual interest paid on money expended on public-utility undertakings was as follows:—State, 3 per cent.; local authorities, 3½ per cent.; water, docks, harbour boards or trusts, 4 per cent.; and supply companies, 5½ per cent. In the case of boards or trusts and supply companies, the interest named is in regard to undertakings that have attained a reasonable measure of success, and represents the average return on all classes of stock or shares.

I do not propose to complicate the arguments for and against any particular type of administrative body by entering into a long discussion as to the ability of one to construct new work at a less cost than another, although a good deal might be said on the subject, and therefore assume that the cost will be substantially the same, and be equally reliable whether such work is carried out by (1) the State, (2) one form or another of public authority, (3) a private company, or (4) a combination of two or more of these interests. The best expert advice would, doubtless, be obtained in either case.

As I have assumed that the constructional work will be on similar lines whatever the type of administrative body, I must also assume that the ordinary working expenses, such as coal, oil, stores, wages, repairs, rates, and taxes, also the amount which is, or ought to be, set aside for depreciation, will be substantially the same in either case, if the undertaking is run on modern lines. You cannot entirely eliminate the personal factor from the question, but outstanding ability is just as likely to be found and utilised by one type of administration as another.

The only items in the cost-sheet which may vary are those due to the interest paid on capital and the cost of management. The first only of these two might be expected to be of any moment, but investigation into a large number of returns shows that in practice the cost of management varies from 3 per cent. or 3½ per cent. of the total revenue in the case of the State or a local authority to 7 per cent. in the case of a supply company.

To illustrate the effect of these two important items, the following particulars are set out on the assumption that the capital expenditure on an undertaking is £1,000,000 and the annual revenue equal to 20 per cent. of the capital expenditure. The working expenses are taken as 60 per cent. of the revenue:—

	State.	Local authority.	Board or Trust.	Company.
	£	£	£	£
(*a*) Working expenses ...	120,000	120,000	120,000	120,000
(*b*) Management	(3%) 6,000	(3½%) 7,000	(5%) 10,000	(7%) 14,000
(*c*) Depreciation	(4%) 40,000	40,000	40,000	40,000
(*d*) Interest on capital ...	(3%) 30,000	(3½%) 35,000	(4%) 40,000	(5½%) 55,000
Total expenses	£196,000	£202,000	£210,000	£229,000

In the case of a Government Department, after allowing for interest on money and for working expenses, including ordinary repairs, no special depreciation or reserve fund is considered necessary. For instance, when a battleship is worn out or lost, it is replaced out of annual taxation, and a similar course is adopted in connection with other Government property. There is really no capital expenditure in the usual meaning of the term, except when the cost of a war or other special outlay occurs which cannot be met at the time out of current income, and has, therefore, to be funded and repaid by instalments on a sinking-fund principle.

The establishment of a State electricity supply would necessitate the funding of the initial costs; the annual contributions to the sinking fund would not, however, be equal to 4 per cent., but in the neighbourhood of 2½ per cent. The difference between 2½ per cent. and 4 per cent. represents £15,000 per annum, so that the total annual cost under the State scheme should really be £181,000 compared with the company scheme of £229,000, thus showing a saving of £48,000, or a reduction of 26½ per cent. in the cost per unit sold.

It may be argued that by the time the State-owned undertaking had reached the position indicated above, the company concern, owing to "initiative and resource," would have developed far in advance of the stage mentioned, and, therefore, its established position as a going concern would be much better. Even admitting such a contention, there still remains the fact that the company must have passed through the same stage as the State, and the comparison at that particular point is, therefore, fair and reasonable. On account of the higher costs incurred by a company under items (*b*) and (*d*), the only expense in its accounts that can possibly be reduced so as to bring the total costs in line with those of the State is item (*a*), which, instead of being £120,000, would have to be cut down to £87,000, and be equal to only 43½ per cent. instead of 60 per cent. of the total revenue. Under the conditions mentioned such a result would appear to be an impossibility.

Those best acquainted with the necessity of developing the supply industry are convinced that the work should be carried out on national lines; and if this conclusion is accepted, it is essential that State funds should be used for the purpose, so as to reduce to a minimum the annual charges against revenue due to the capital expenditure, which represents such a large percentage of the total cost per unit sold. A Central Government Authority with the best advice in the country at its disposal may fairly be expected to ensure that the money provided from Imperial resources shall be wisely spent. The arguments in favour of State intervention appear irrefutable.

The next point to consider is what type of District Board should be appointed to exercise the powers which would be conferred upon it by the State.

Taking, first, the possibility of administration direct by the State, there is not at present in existence, so far as I know, any Government Department exercising powers quite of this kind, but presumably in each of the 16 districts a district commissioner would be apppointed, who would be assisted by a skilled staff somewhat on the lines of the advisory experts of the Central Government Authority, although in this case an individual might be responsible for the work of more than one branch of the Department. The District Commissioner would be a man of wide outlook, and would previously have held a high executive position with a large supply undertaking, although he need not necessarily be an engineer by training. Subject only to the supervisory powers exercised by the Central Government Authority, who would co-ordinate, when necessary, the work carried out in adjacent districts, the District Commissioner and his assistants would be responsible for the design, construction and operation of all power stations and main transmission lines, and, in some instances, of distributing systems also. All proposals involving capital expenditure would be investigated by the Central Authority, and, if passed by them, State funds would be advanced for the purpose. It would be cumbersome and undesirable to deal with all financial transactions on present Government lines, *i.e.*, through a departmental office situated in London. The District Commissioner should have full powers to purchase and pay for all materials, and for the receipt and disbursement of the income, under general regulations laid down by the Central Authority.

It is unnecessary to go very closely into the present form of local authority administration. The powers are vested in the City, Borough, or Urban District Councils, and it is usual for the Council to delegate such powers to a Committee, the Council retaining the right to intervene when, for any special reason, intervention appears necessary in the public interest. The chief executive officer is the engineer, and the Committee is advised on law and financial matters by the town clerk and borough treasurer. Theoretically, such a Committee forms a suitable body to carry out the duties, as it usually consists of men representing a wide diversity of interests, such as large and small businesses, the various professions, and a sprinkling of Trade Union officials. A defect of the system is that only in rare instances are elected representatives placed on a Committee on account of special fitness for the position. The appointments are made too often on pure party lines, or due to seniority. The chairman and deputy-chairman of the Committee (of opposite political persuasion) occasionally retain office for considerable periods, and in such cases are able to be of real service to the undertaking. In other cases the chairman and deputy are appointed only for a limited period to enable the office to be held by a larger number of individuals. All appointments of this kind are subject to change through the whims of the electors. Continuity of policy is an important element in the development of any business undertaking, and any system of administration is defective that necessitates a change in personnel due to no fault in the services rendered.

There are not a large number of boards or trusts in existence, and it is consequently a little difficult to out-limit such an organisation. Speaking generally, they consist of men of standing appointed to represent various authorities who are concerned either financially or otherwise in the undertaking. A Water Board, for instance, mainly consists of individuals elected by the Local Government Authorities in whose area the supply is given—such as County, Borough, or Urban District Councils—and is, therefore, closely akin to a single Local Authority Committee or Council. A Harbour Board or Trust consists of representatives appointed by Government Departments—such as the Admiralty, the Board of Trade, the Trinity House—and by Local Authorities in whose area the harbour is situated, together with others elected by those who use the undertakings, such as the owners of ships, warehouses, and wharves.

The administration of a supply company is conducted by a board of directors, each of whom must be to a greater or lesser extent interested financially in the undertaking. A portion of the directorate often represent large manufacturing concerns who were associated with the formation of the company as contractors for plant or other equipment, and by reason of obligations then agreed to, the undertaking places extensions in the hands of certain firms. Although formed primarily for the purpose of affording a supply under statute, there is no doubt that incidentally those who provide the "Sinews of War" are out to obtain as large a return as possible on the capital. Part of the capital of some of the larger companies is entirely unrepresented by assets, due to excessive formation expenses or to underwriting the capital issues. The financial arrangements made by certain companies in connection with subsidiary concerns have been the subject of serious criticism. On the other hand, it is pleasing to place on record an appreciation of the high business standard adopted by some directors when piloting their companies through periods of exceptional difficulty into the comparative calm of established prosperity. Many directors and engineers are undoubtedly men of outstanding ability, but financial considerations are very liable to outweigh all others.

Summarising the chief points dealt with in the foregoing remarks, it might seem that as a plain and straightforward business proposition, a combination of cheap capital provided by the State, and the ability of a board of directors to obtain the largest possible return on capital, would offer an excellent solution to the problem; but, on second thoughts, it will be seen that the members of the board would not be personally interested in the financial results. There would, therefore, apparently be absent that "initiative and resource" which is supposed to be so "distinctive of private enterprise." Any division of the capital responsibilities between the State or local authorities and private interests, as was suggested some time ago to deal with one important area in the country, would only be a compromise without securing that important advantage to the cheapening of the supply which the use of State funds alone can give.

In order to ascertain the various interests involved, it will be convenient to define more clearly the duties which the District Board will have to carry out.

A certain amount of controversy has arisen as to the extent to which any scheme of reorganisation should be carried. For instance, is the new administration to be responsible only for the so-called super-stations and main transmission lines, and afford bulk supplies to existing undertakers, or should it acquire the whole of the existing power stations? A further alternative is to take over only those power stations which can, for the time being, be used efficiently, and rely on low charges for a bulk supply automatically to shut down the small local plants. Another point of importance has reference to the acquisition of existing distributing networks.

Dealing with the last-mentioned matter first, the general opinion expressed by associations or undertakings most intimately concerned, is that distribution in detail can be both efficiently and conveniently dealt with locally; these powers should, therefore, remain in the hands of existing undertakings, subject to such adjustments of boundaries as may be found necessary to make the areas more compact. The special knowledge obtained by the local undertakers will then be used to the greatest advantage in developing the demands amongst the industries and residents in the areas.

The question as to the ownership and operation of main transmission lines is more complex, bearing in mind the fact that these lines will, or may, be used for (*a*) affording supplies to authorised distributors; (*b*) the interchange of supplies between adjacent power stations; (*c*) supplies to districts where statutory powers have not yet been exercised; (*d*) supplies to large individual consumers situated on the run of the lines in existing statutory areas; (*e*) large supplies to railways, canals, &c. There will probably be complete agreement that the authority owning and operating the power stations should also own and operate all lines used for purposes (*a*), (*b*), and (*c*), and as no powers have been obtained by the local authorities mentioned under (*c*), they will suffer no loss if the work is undertaken on their behalf by the District Board. Under heading (*d*) would fall supplies to large electrochemical, metallurgical, and other similar industries, which would be given on special terms and conditions requiring the closest co-operation between the power stations and the consumers. It is, therefore, desirable that the authorised distributor should relinquish these rights subject to a payment to them of an annual acknowledgment based on a percentage of the annual income derivable therefrom. This arrangement would also avoid any division of responsibility in regard to the transmission lines, as the construction, operation, and maintenance would remain absolutely in the same hands as the power stations.

(To be concluded.)

THE MECHANICAL DESIGN AND SPECIFICATION OF THE TURBO-ALTERNATOR ROTOR.

By S. F. BARCLAY, Ph.D., B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Continued from page 296.*)

There are limits to the size of forging that a steel manufacturer can undertake. The largest size of rotor that can be produced in a single piece is in the neighbourhood of 50-in. diameter. For all outputs so far contemplated at 3,600, 3,000, and 2,400 R.P.M. a single forging can be obtained, and also for all except very large outputs at 1,800 and 1,500 R.P.M. For very large outputs at 1,800 R.P.M. and lower speeds the soundest construction is to forge a hollow cylinder carried on a through shaft as shown in fig. 2. Forging the cylinder on a mandrel does work on the steel, and gives it its best qualities on the inner periphery where the hoop stress is a maximum. Moreover, in quenching, the oil has access to the bore and the maximum benefits of the heat treatment are conferred at the part of maximum hoop stress. With such large rotors there is no difficulty in so proportioning the belt of metal between the bottom of the slots and the bore that the hoop stress is kept down to a satisfactory value. For very large rotors this construction, therefore, constitutes an excellent arrangement.

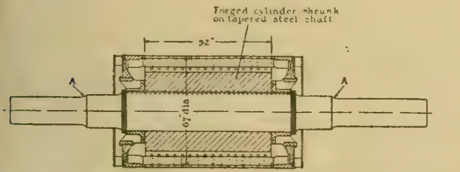


Fig. 2.—Rotor for a Large 1,000-R.P.M. Turbo-Alternator.

In determining the design of the shaft it is most important that the proportions should be such that the curve of deflection is smooth and free from any sudden change. For the structure to be safe, not only must the area of the steel be adequate for the load to be carried, but the proportions must be such that it is free to yield elastically to exert its reactive force without any local over-stress being caused. Where there is an abrupt increase of diameter in a shaft, the shaft portion is under stress, and is yielding elastically. The flow of stress into the larger diameter is somewhat gradual, and the face of the metal that is rising at right angles from the smaller to the larger diameter carries little or no stress; there is, therefore, in intimate contact steel that is elongating and compressing elastically and steel without stress, and great weakness is thus caused. A gradual change of diameter represents a normal design, and a sudden change is to be regarded as adding metal to the normal design as shown shaded in fig. 3. The added metal tends to prevent the normal elastic deformation, and has inadequate strength for the purpose.

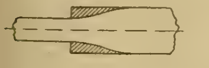


Fig. 3.

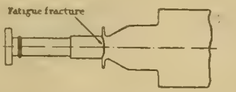


Fig. 4.

Fig. 3.—A Sudden Increase in Diameter Regarded as Adding Metal to a Gradual Increase.

Fig. 4.—Solid Forged Rotor with Defective Shaft Design.

In fig. 4 is shown a case of failure that came to the author's notice a few years ago. It will be noticed that there is a very sudden increase of diameter between the bearing journal and the large oil baffle that is formed solid with the shaft. After 11 months' running the shaft broke in the position shown. Not only was the design thus most unsound, but the material was unsuitable, being a high-carbon steel that had not been heat treated, and had a very coarse grain size.

Abrupt changes in the curve of deflection must therefore be carefully avoided. The shaft should be gradually stepped to avoid any sudden increase of diameter, and wherever a change of section occurs a carefully formed radius should be provided; the radii should be given a fine finish and good polish.

The need for avoiding abrupt change of section applies to all parts of the rotor, and at the junction between the teeth and the body of the rotor ample radii should be provided.

The maximum reverse stress in the rotor is in the neck of the bearing journal at the part marked "A" in fig. 2. The weight of the rotor puts the fibres at the top of the shaft into compression, and at the bottom of the shaft into tension. As the shaft turns round the stress changes from tension to compression. In the case of a 3,000-R.P.M. alternator the number of reversals per day is 4,320,000, a number equal to what investigators into the subject of alternating stress have regarded as a complete endurance test.

The conditions necessary for failure by fatigue are that the real elastic limit of the steel is exceeded, but that the yield point is not reached. If the elastic limit were not reached, the metal would not fail however many reversals might be made; if, on the other hand, the yield point were reached the failure would take place by ductile elongation before fatigue developed.

It is fairly certain that failure by fatigue is independent of the speed of the reversals unless the speed be very low or very high. It is probable that at the normal running speed of the high-speed alternator the alternations of stress have a maximum effect, since the speed is not sufficiently high for it to have any ameliorating effect, and, on the other hand, the great speed tends to bring unforeseen load into play. It becomes necessary, therefore, to give very careful attention to the design in this respect.

The fatigue failure is so insidious in its action, and so many unforeseen factors may be present to contribute to it, that a big margin of safety is desirable. For instance, the calculated stress may be much exceeded by a slight error of alignment, and the possibility of minute irregularities or flaws must be considered, which for any other condition of loading would be without practical effect. Moreover, the torsional stress which is a contributing factor may have its normal value much exceeded by a short-circuit. Further, the true elastic limit, which determines fatigue failure, is considerably lower than the yield point. Taking all these factors into consideration, it is the author's opinion that the combined calculated stress in the neck of the journal should not exceed 7½ per cent. of the yield point of the steel. With the high bearing duties of to-day—journal speeds of 6,500 ft. per minute being quite satisfactory—there is no difficulty in keeping within this factor of safety.

The rate at which steel cools has a profound effect on its structure and physical properties. The greater the temperature to which steel is heated, the longer it is maintained at high temperature, and the more slowly it is cooled the greater is the crystal size and the less dependable is the steel. A medium carbon steel of the kind suggested for the rotor has its yield point increased about 30 per cent. by oil hardening. It is seen, therefore, that the correct oil treatment of steel very considerably improves its tensile strength, and also puts the steel generally into better condition and makes it more reliable. For these reasons it is very desirable that all alternator rotor forgings should be oil treated. The approximate treatment of the steel in question would be to immerse in oil at about 800 deg. C. and temper at about 550 deg. C., the treatment varying according to the carbon content. The heat treatment should be carried out after the forging has been rough turned.

As already indicated, the most highly stressed part of the rotor is in the end-bells retaining the rotor end-windings, and the design of the bells, therefore, requires the most careful attention. In the case of a 5,000-KW. alternator at 3,000 R.P.M. with a 31-in. diameter rotor, at the overspeed of 20 per cent. above normal, the centrifugal force exerted by the windings at each end of the core is about 820 tons. If to this is added the centrifugal force of the bell itself, the total centrifugal force at each end is about 2,000 tons. For such enormous forces it is obvious that the material employed must be very high grade.

In considering the choice of material for the end-bells the designer naturally has preference for non-magnetic material. With the end bell registering on the rotor core, if it is magnetic it offers a direct leakage path of considerable area from pole to pole. In the case of an average 5,000-KW., 3,000-R.P.M. alternator at full load the leakage is of the order of 10 per cent. of the excitation energy. Before steel bells were tried it was thought that there might be heating in them due to leakage flux from the stator, but experience shows that such is not the case, the reason being that any such flux rotates synchronously with the bell. It was thought also that for solid bells of any material such a large mass of metal close to the end of the stator core might cause undue heating due to eddy currents induced by the action of the flux swinging from tooth to tooth. Such, however, is found not to be the case.

The magnetic end-bells appear to have one rather remarkable effect in causing great heating in some cases at the ends of the stator core when running on short-circuit. In two cases of 5,000-KW. alternators at 3,000 R.P.M., embedded thermo-couples placed ½ in. from the end of the core showed a rise of 250 deg. F. after an hour's run on short-circuit. The temperature rise of the cast-iron end-plates was about 120 deg. F., showing that the greatest heating was in the laminations themselves. The author suggests that this phenomenon is probably due to the steel end-bells. Since the effect does not occur under any running condition, it is of little importance. It may, however, quite upset the method some makers have of forecasting the temperature rise on load from light-load tests—with which one factor is the temperature rise on short-circuit. Moreover, it may cause the designer to attribute to eddy-current loss in the copper a loss that is due to something else altogether.

Of the non-ferrous metals available for making end-bells the best is a high-grade manganese-bronze. This has an ultimate strength of about 44 tons per sq. in., a yield point of 22 tons per sq. in., and an elongation of 20 per cent. The real elastic limit of the material as shown by its behaviour under reversals of stress is lower with regard to the yield point than with a good steel. For this reason the author is of opinion that the maximum stress should not exceed 45 per cent. of the yield point.

In fig. 5 is shown the average load per axial linear inch that the end-bell has to carry due to the centrifugal force of the end coils for a rotor for 3,000 R.P.M. of 31-in. diameter, calculated at the overspeed of 20 per cent. above normal. The bottom curve shows for various thicknesses the load that the manganese-bronze can carry in addition to itself with a stress equal to about 45 per cent. of the yield point—*i.e.*, 10 tons per sq. in. With a 31-in. diameter rotor it will be seen that the manganese-bronze can only just carry itself when its thickness is varied from 0 up to about 0.7 in. If the thickness is further increased, the stress is increased, and exceeds the safe value for the material. It is satisfactory for 3,000-R.P.M. rotors up to about 22-in. diameter.

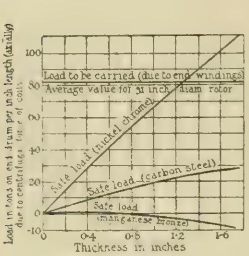


FIG. 5.

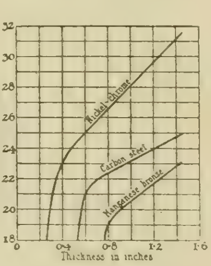


FIG. 6.

FIG. 5.—5,000-KW., 3,000-R.P.M. ALTERNATOR.

FIG. 6.—MINIMUM THICKNESS OF END DRUM REQUIRED FOR DIFFERENT DIAMETERS OF 3,000-R.P.M. ROTORS.

Oil-treated carbon steel can be used satisfactorily for the end-bells of rotors up to about 25-in. diameter at 3,000 R.P.M., but not for any larger diameters. The curves for the carbon and for the nickel-chrome steel are based on working at 50 per cent. of the yield point of the material, the carbon steel having a yield point of 22 tons per sq.in., and the nickel-chrome steel 40 tons per sq. in. Even for the smaller diameters, however, there are advantages in favour of using nickel-chrome steel. For instance, for a 25-in. diameter rotor a thickness of 1.43 in. is necessary for carbon steel, whereas with the nickel-chrome steel 0.6 in. would be sufficient. The magnetic leakage with the nickel-chrome steel would be much less, and the flow of the ventilating air into the air gap would be less restricted. For rotors more than 25 in. in diameter nickel-chrome steel should always be used. Nickel-chrome steel containing about 3.5 per cent. nickel, 0.5 per cent. chromium, and 0.25 per cent. carbon has an ultimate strength of about 50 tons per sq. in., a yield point of 40 tons, an elongation of 18 per cent. on a 2-in. test-piece, and a reduction of area of 50 per cent.

Hadfield's manganese steel is quite unsuitable for end-bells, having a very low yield point, and having the remarkable quality that, although really soft, deformation makes it extraordinarily hard, and it cannot be machined.

Magnetisation appears to be due to the arrangement of the atoms in the molecule, or of the molecules themselves, and is not a property peculiar to the atoms of those elements that are magnetic. There is the effective proof furnished by Heusler that an alloy containing only non-magnetic elements may be magnetic. He produced such an alloy composed of 60 per cent. copper, 26 per cent. manganese, and 14 per cent. aluminium, all of which elements are non-magnetic. On the other hand, alloys containing a large percentage of iron may be non-magnetic.

Whereas with carbon steel oil treatment is desirable, with nickel-chrome it is indispensable. As with the rotor, the end-bell forgings should be rough turned, and then be heat treated.

(*To be concluded.*)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered o sufficient interest.

A New Automatic Oil Switch.

Many of the causes which open oil switches in modern power transmission or distribution circuits are quite transitory in nature, *e.g.*, a bird may short-circuit two overhead conductors, pay the penalty, and be quickly incinerated; or a sudden heavy overload or a cable-"short" which clears itself may open the oil switches. A moment or two later, the switch might generally be closed again, and normal service be resumed. Where there is an attendant always at hand, the opened switches are re-closed almost immediately to see whether they will hold in, but where switches in a remote transformer station are concerned it may often be an hour or more before an attendant can arrive to test the switches, and during the whole of this time service is interrupted—probably unnecessarily.

A switch which will close again automatically after, say, three minutes, remain closed if the circuit be then clear, or reopen and remain open if the fault be still present—such a switch offers great possibilities in the way of improved service to consumers and reduced costs in respect of switch attendance. The switch described below (from *E.T.Z.*) fulfils these functions, and is due to Voigt & Haeffner, Frankfort-on-Main. A three-phase motor of about 1/10-H.P. is switched in circuit when the oil switch opens on a fault. This moto is geared down through a worm-wheel and cam in such a manner as to place a closing spring under full tension in about three minutes. At the end of this period the spring comes into action, and closes the main switch. If there i no longer a fault on the network the switch remains closed, and ready to operate as before on the occurrence of a fresh fault. If the fault has not been cleared before the switch i closed automatically, the switch reopens instantaneously, and cannot be closed again except by an attendant. The automatic gear is built on to a standard oil switch.

This automatic equipment has been used satisfactorily in various works for more than 18 months past. Perhaps it chief application at present is in isolated transformer station feeding bulk consumers of various descriptions. Anothe useful function is to connect automatically a reserve line (where such is provided), should the main supply fail fo any reason. A number of the new switches suitably arrange in any distribution network will automatically confine an interruption of supply to the smallest possible section of th system.

A New Bolt Switch.

A new bolt switch shown in fig. 1, and manufactured by **MESSR WARD & GOLDSTONE**, Sampson Works, Salford, Manchester, ha been placed upon the market to meet the requirements of a order recently issued with regard to ship lighting, which state that deck houses, cabins, lavatories, &c., are to be fitted with doo

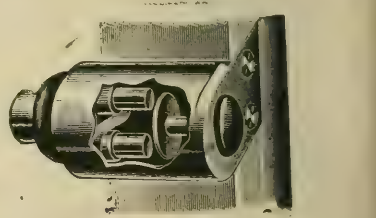


FIG. 1.—W. & G. BOLT SWITCH.

switches, so that the light is automatically switched off when person leaves the room, thus preventing any beams of light fro showing on deck. The switch which we illustrate appears t comply excellently with the conditions. It is operated on enterin the room by pressing the ordinary bolt into its socket, and o leaving the room the bolt is withdrawn, automatically turning th light off.

This bolt switch is of strong construction, the body being gun-metal, and the action decisive. Numbers have already bee sold for the purposes above mentioned.

LEGAL.

German Agents for Ferro-Tungsten.

On March 26th, in the King's Bench Division, before Mr. Justice Bray, an application was made on behalf of the Thermo-Electric Ore Reduction Corporation, of High Holborn, London, under the Legal Proceedings Against Enemies Act, for a declaration that an agreement between plaintiffs and the respondents (Gebruder Röchling), carrying on business at Saarbruck, Mannheim, Dinsburg-on-Rhine, Volklingen, and Diedenhofen, in the German Empire, was dissolved by the existence of a state of war between Great Britain and the German Empire.

Mr. Theobald Mathew, for the plaintiffs, said the plaintiffs were smelters of wolfram concentrates, and produced the product ferro-tungsten, which was largely used in the manufacture of steel, and particularly of hard steel and high-speed tools. By an agreement made in 1913, respondents were appointed the sole agents of the plaintiffs in all countries except England and America. The proposal was that the plaintiffs should put at respondents' disposal a minimum of 700 tons per annum, and respondents were to have a commission on c.i.f. prices. The agreement was to last 10 years.

Mr. A. F. McLaren, managing director of the plaintiff company, stated that the plaintiffs supplied respondents with tungsten up till the beginning of the war. One of the terms of the agreement was that respondents should take 3,000 £1 shares in the plaintiff company, and this was done. At the outbreak of war witness gave notice to the Public Trustee of respondents' holding in the company, and since the outbreak of war plaintiffs had ceased to carry out the contract.

Mr. Justice Bray made a declaration that the agreement between the plaintiffs and respondents was closed, the declaration being without prejudice to liabilities already incurred. He also gave plaintiffs their costs, an appearance to the action having been entered by the respondents.

Pintsch's Electric Manufacturing Co.

Before Mr. Justice Bray, in the King's Bench Division, on March 26th, application was made under the Legal Proceedings Against Enemies Act, 1915, by Pintsch's Electric Manufacturing Co., of Croydon, for a declaration that certain royalties to Hugo Grob and Julius Pintsch, Actiengesellschaft, Berlin, were no longer payable, owing to the existence of a state of war between Great Britain and Germany.

Mr. J. H. Stamp, who appeared for the plaintiffs, said that respondents had written saying they did not intend to appear. The first respondent, Mr. Hugo Grob, was the patentee of an apparatus for use in electric lighting on railways, and the respondent company were the manufacturers of that apparatus in Berlin. Plaintiff company was formed here to take over certain areas covered by the respondent Grob's patents, these being worked in conjunction with the Germany company. The scheme was that the latter company should take half shares in the plaintiff company. The spheres of influence of the German and English companies were mapped out. The English company were to obtain their supplies of the manufactured articles from Germany, and were to pay Mr. Grob, the patentee, certain royalties. The question was whether the royalties payable to Mr. Hugo Grob should be continued after the war. The respondents were by this agreement to take half the shares in the plaintiff company, amounting to £5,000, and 5 per cent. of the net sale price was payable as royalty as long as the patents remained in force.

Mr. C. P. Whitcombe, managing director of the plaintiff company, said the agreement was acted upon till the beginning of the war. The manufacturing was done entirely in Berlin, which supplied the plaintiffs with the apparatus and such parts as were needed. As the result of the outbreak of war, the plaintiff company were held up, so far as placing machines was concerned, as they had no facilities for manufacturing themselves, and it was an important condition of the agreement that the manufacturing should be undertaken by the respondent company.

In reply to the Judge, Witness said plaintiffs arranged to keep in order the apparatus supplied to the railway companies. They really ceased to canvass for orders owing to their inability to supply.

The Judge: Then the royalties would be running if the agreement were to stand?

Witness said the royalties went on accruing under the minimum clause. The plaintiffs would have to go on paying under the minimum clause, even if the supply or sale ceased.

The Judge: That is the liability you desire to get rid of?

Witness: Yes.

The Judge pointed out that there was a letter from Hugo Grob protesting that he was not an enemy but a neutral.

Mr. Stamp said that by the Act any person or body of persons of whatever nationality carrying on business or resident in an enemy country was to be treated as an enemy, and therefore that was Mr. Grob's definition all along. Throughout it was insisted that Mr. Grob and the respondent company and the plaintiff company should assist one another in the most close terms.

His Lordship pointed out that Mr. Grob's letter was addressed from Zurich.

Mr. Stamp said that was the "camouflage." Mr. Grob was served with the papers in Germany.

His Lordship said he would look into the agreements and give judgment on the following day.

On the hearing being resumed for judgment on March 27th, Mr. Stamp (counsel for the plaintiffs), in reply to the Judge, said that there had been an arrangement by the plaintiff company with another English company. He only asked, however, for a declaration that the plaintiff company was not liable to pay.

His Lordship, in giving judgment, said he was of opinion that the agreement was dissolved on the outbreak of war. He would make the declaration asked for, but without prejudice to all other questions that might arise between the plaintiffs, the other English company, the German company, and Mr. Grob. He did not think he could do more than that.

Great Eastern Railway v. Postmaster-General.

At the Surveyors' Institution, Westminster, on March 25th, Mr. J. H. Oakley (of Messrs. Daniel Smith, Oakley & Garrard), as Arbitrator, began the hearing of a claim by the Great Eastern Railway Co. for £33,393 compensation from the Postmaster-General by reason of the taking of so much of the sub-soil as is required for the Post Office Tube Railway under Liverpool Street Station, and for injurious affection to adjoining lands by the carrying-out of such works.

Mr. G. M. Freeman, K.C., Mr. H. Courthope-Munroe, K.C., and Mr. Bruce Thomas were counsel for the claimants, while the Solicitor-General (Sir Gordon Hewart, K.C., M.P.), Mr. Lewis Coward, K.C., and Mr. G. W. Hildyard represented the Postmaster-General.

In opening, Mr. Freeman said that in 1913 the Postmaster-General promoted a Bill for the purpose of constructing a tubular railway, with stations at various places, for conveying parcels and letters between Post Offices in different parts of London, and incidentally between some of the railway stations; for a substantial length the tube railway went underneath the Liverpool Street Station of the claimant company, part of their hotel, and part of their offices. It was at such a depth that, if carried out as proposed, it would materially interfere with the user of the sub-soil. It was quite impossible to enlarge Liverpool Street Station on the surface. If they were to have any enlargement at all, it would only be by going down into the bowels of the earth. When the Postmaster-General's Railway Bill came before Parliament, the claimant company asked the Committee to safeguard for the Great Eastern such a stratum of sub-soil between the surface of the station and the top of the Postmaster-General's tube as would enable them to utilise it for the purpose of an underground station, which was part of the company's scheme. The top stratum was preserved by a clause of the Act, the remainder was left to compensation. Counsel insisted that the position of a railway like the Great Eastern was quite different from that of a case where a deep-level railway was under a street or under private property, and that the nominal compensation that might apply to the latter could not be justly applied to a railway which was prohibited from extending itself on the surface. Owing to the requirements of the traffic of the company, some very large developments in the sub-soil underneath the station would have been a necessity at no very distant date had the normal condition of things continued.

Colonel Thornton gave evidence, saying he was general manager and engineer-in-chief of the Great Eastern Railway Co. He said he saw no way of extending Liverpool Street Station except by going underground. First, the railway, in order to relieve the traffic congestion, must be electrified. Secondly, it would be necessary to develop an underground station beneath the present station. The great difficulty they had at the present time was suburban traffic arriving within certain limited times. Between 8.30 and 9 a.m. as many as 18,000 passengers alighted at Liverpool Street Station. In 20 years the traffic rose from 92,000 passengers to 198,000, or about 116 per cent, and he thought there would be a continual increase of the traffic at Liverpool Street Station. If the Great Eastern Railway was to deal with its present traffic satisfactorily, it must electrify even if there were no increase in traffic, and it must avail itself in doing that of the sub-soil underneath Liverpool Street Station. If a considerable sum of money was spent it must be spent to electrify the Great Eastern for the suburban zone. Either through connection with existing tube lines, or through the construction of another independent tube line, they must provide some means of placing their passengers not only in the heart of the financial district of the City, but also in the shopping districts. The great bulk of the suburban traffic of the Great Eastern lay within 10 miles of Liverpool Street. Beyond that, as a suburban residential district, the territory was relatively untouched. If proper travelling facilities could be given that property would become available and desirable for residential purposes. He could only give that service through electrification. The sub-soil of Liverpool Street Station was well adapted for a goods station, and more particularly for a cold storage warehouse. In carrying out such a work they would impinge on part of the sub-stratum occupied by the Postmaster-General. In witness's opinion, the sub-soil for a very considerable depth beyond that reserved under the Act of Parliament to the Great Eastern had a commercial value for the company, and if it were to be taken away from them for all time the company ought to be paid its fair commercial value. "Although," added Colonel Thornton, "there is no fair commercial value; as a matter of fact, I would infinitely rather not have tubes in their present location, irrespective of any amount that might be paid; £100,000 or £200,000 would not tempt me to give up this site. We are limited as to the height we may go above ground; there is no limit underground."

In cross-examination by Mr. Lewis Coward, K.C., Colonel Thornton said that Mr. Hyde was general manager in 1913, when the proceedings in reference to the Post Office Tube Railway took place in Parliament.

Mr. Coward: The then general manager said that there was room to get an underground station between the surface and the Post Office Tube, underneath Liverpool Street Station. Do you agree with him?

Colonel Thornton: I agree with that in part—not entirely. There is room for an underground station, but there is no room for the developments I have just described.

In further cross-examination, Colonel Thornton said the Central London Tube Railway tunnels were 16 ft. above those of the Post Office Railway. The top of the Post Office Railway was 55 ft. below the rails of the Great Eastern Railway. The Central London Railway occupied one corner, which had an area of one-fifth of the total area of Liverpool Street Station. Witness did not agree that this railway, and not the Post Office Tube, would obstruct the building of a deep-level railway by the Great Eastern.

Mr. J. H. Wardley, assistant to the engineer-in-chief of the Great Eastern Railway, next gave evidence. He said that in view of the possibility of the user of sub-soil underneath Liverpool Street Station, he had prepared a plan showing 15 schemes that would be interfered with by the occupation of this sub-soil by the Post Office Tube Railway.

Sir Alexander Stenning, surveyor, said he had inspected Liverpool Street Station on many occasions. The tubes were constructed diagonally, and that caused severance and damage. He arrived at a value of £8,840 in respect of the land occupied. In respect of the severance, he placed the value at £24,553.

Mr. C. A. Lang, senior partner of Messrs. Jonas, Lang & Co., said his total valuation of compensation amounted to £33,111.

Mr. Dendy Watney arrived at a valuation of £32,470.

This was the case for the claimants.

Before the case for the Postmaster-General was opened, Mr. H. H. Dalrymple Hay (engineer of the Post Office Tube Railway) gave evidence, in order to allow of his presence in the law courts.

The case was resumed on Tuesday, when Mr. Leslie R. Vigers, surveyor, gave evidence on behalf of the Postmaster-General, and valued the compensation payable at £4,269. A payment of £150 was made by the Central London Railway to the Great Eastern Company. Since the case of the Marquis of Northampton v. the Great Northern Railway, 15 years ago, £1 per foot run had been the conventional rate for running tunnels, other than stations, under property. He saw nothing to differentiate this case from the established custom.

Mr. Howard Martin, surveyor, submitted a valuation of £4,400.

Mr. Douglas Young, surveyor, submitted a valuation of £4,270.

Mr. R. A. Dash, Inland Revenue valuer, said he had negotiated in over 100 cases for the assessments of the Post Office Tube Railway from Paddington to Whitechapel. All these cases had been settled on the conventional rate.

In cross-examination by Mr. Freeman, Mr. Dash said that in the case of Paddington the tube ran under some of the lines. The amount of the claim was £687, and it was finally settled for £500.

Sir Robert Bruce, Controller of the London Postal Service, said he regarded it as a distinct advantage to the Great Eastern Co. that the tube should be there, from the point of view of relief of traffic.

The Solicitor-General, in addressing the Arbitrator, said the schemes of which they had heard came into existence after it was decided to make this claim, and all of them, without a single exception, could be carried out without in the slightest degree being hampered by what was being done on the part of the Postmaster-General. The depth ranged from 75 ft. below the surface of Liverpool Street to 55 ft. below the surface of the rails of Liverpool Street Station. The sub-soil at that depth could only have a most fanciful and speculative value. There was no reason why the claimants should be paid more compensation than had been paid to others.

Mr. Freeman having replied, the Arbitrator said he would give the matter his consideration, and announce his award in due course.

WORKMEN'S COMPENSATION CLAIM.

At Preston County Court, last week, Judge Sturges, K.C., gave his adjourned judgment in the action brought by Mrs. Susannah Croft against the United Electric Car Co., Ltd., Preston, for compensation for the loss of her husband. The deceased was struck on the head by a flying piece of an emery wheel, and afterwards died in Whittingham Asylum.

His Honour found that death was accelerated by the accident, and he awarded the sum of £250 as compensation, with costs.

"Dirty" Work.—A Newcastle newspaper states that at the Munitions Tribunal for the Newcastle area, an electrician was charged with neglecting his work. Captain Wood said that the man was sent as a war munition volunteer from London to work in this district. He began to complain soon after starting that the work was dirty, and demanded "dirty money" rate of pay. When this was refused, he suggested to the others that they should "down tools." This they declined to do, and defendant then absented himself. A fine of £2 was imposed.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coil v. Magneto.

As a motorist of 19 years' experience, and recently in charge of the testing department of a prominent firm of lighting and ignition apparatus manufacturers, I have for years felt convinced that the coil must inevitably regain its lost supremacy.

Granting the present-day magneto all the credit it justly deserves, I believe all those experienced will admit the simplicity and reliability, not to say charm, of a high-class plain coil with a really good contact-breaker (not the type we were usually accustomed to), aided by sound wiring and safe terminals, &c. A good coil might be almost said to be "infallible," but I fear we would hardly care to refer to the respected magneto likewise.

The buyer gets a cheaper (possibly more reliable) car, and armed with a small test lamp and fault-finding diagrams (American style), he "tackles" and overcomes most ignition troubles, whereas the same person confronted with the slightest magneto trouble would "throw up the sponge."

Unsettled.

WAR ITEMS.

Exemption Applications.—At Southwark, Coun. Hewitt, who is a member of the Tribunal, electrical engineer, of Southwark Bridge Road, applied for the exemption of two metal workers, 29 and 27 years old respectively, one in Grade 3 and the other in Grade 2, and for a fitter, 34, in Grade 2. The National Service Representative opposed the further exemption of the metal worker in Grade 2. The Tribunal granted the metal worker in Grade 3 and the fitter six months' exemption, and the other man three months.

At Burnley, an electrician, who appealed for his chief assistant (30, Grade 2), said the man was engaged principally on the maintenance of plant. The firm were working for four munition works, each of which could reserve an electrician for themselves. Exemption to May 31st was given.

In granting exemption to June 25th to a number of motormen in Classes A and B1, Rochdale Tribunal expressed the hope that every effort would be made to release the men. Mr. G. Webster, manager of the Corporation Tramways, said the system was on the minimum. Numbers of discharged soldiers had been taken on, but many had to give up as they found driving too great a strain. Nervy or shell-shocked men were useless.

A decision of importance to electrical goods traders, of which there is a number in Shoreditch, was arrived at by the Local Tribunal, on Saturday, to appoint a committee to run one-man businesses. Quite a number of dealers in electrical goods have been before the Tribunal, and on occasions there has been difficulty in granting exemption as it was felt that the man ought to be in the Army owing to his medical classification. The fact that it was a one-man business, however, had decided the Tribunal to give exemption. Now Capt. Fisher, the National Service Representative, said he had been asked by the authorities to get a committee formed to run them, or a refusal to do so. After discussion, it was decided to appoint a committee to run the businesses.

At Oxford, the National Service Representative had a review of conditional exemption granted in July, 1916, to G. A. King (37, Grade 2), electrician at Keble College. The certificate was withdrawn, and two months' temporary exemption substituted.

Before the Warwickshire Appeal Court, exemption for J. S. Allsopp (41), electrician, was applied for by Mrs. Gaskell, of Diana Lodge, Kineton. As the man was over military age when called up, the military agreed to release him, and the appeal was withdrawn.

The Colchester Tribunal has granted conditional exemption to W. Fenner, engaged on the Corporation tramways, whose category has been lowered to Grade 3.

At Torquay, exemption was applied for for J. W. Lane (B 2), jointer and electrical fitter at the Corporation electricity works. The acting manager, Mr. Keenan, said that Lane was the only man available for repairs at the works, where they were 50 per cent. understaffed. A month was allowed.

At Chelmsford, an electrician (Grade 1), at present engaged on Government work, appealed for exemption, but Capt. Smith said that this was the class of man the Army needed. Exemption was refused.

At Grantham, the Urban Electric Supply Co., Ltd., appealed for the retention of H. Dinsdale (25), and six months were conceded.

At Sutton-in-Ashfield, Mr. B. Walton appealed for R. W. Bance (37), electrician at his factory, in charge of an engine, nine motors, and the lighting. Six months were granted.

Enemy Businesses Wound Up.—The "Board of Trade Journal" for March 28th contains a consolidated list of enemy businesses ordered by the Board of Trade to be wound up. The list is complete to date, and is accompanied by an alphabetical index of names. The number of concerns dealt with is 521.

BUSINESS NOTES.

A General German Electrical Syndicate.—The Central Union of German Electrical Engineering has just been formed in Berlin for the uniform representation of the economic interests of the industry, and all the manufacturing firms are said to have become constituents of the Union. Hitherto, only a loose, or non-binding, association had existed during the course of the war, and this has now been given a permanent form by the creation of the Union.

Protection in Sweden—and England.—As was mentioned in our issue of March 22nd, the chairman of the British L. M. Ericsson Manufacturing Co. put forward a plea for the adoption of a large measure of Protection for industry on the arrival of the appropriate time, he having in view principally, if not wholly, manufactures of enemy origin in the future. By a curious coincidence a similar proposal had just previously been made by the Aktiebolaget L. M. Ericsson & Co., of Stockholm. This company has addressed an application to the Government asking for Customs protection for the company's electrical apparatus for switching and signal safety installations, which are now manufactured on such a scale as to be able fully to meet the country's home requirements. According to the experience gained since the company began in 1915 the construction of this particular type of apparatus, which was previously obtained exclusively from abroad, foreign makers have offered their manufactures at dumping prices, with the object of retaining the business. In many cases these prices, the company states, have been considerably below those which prevailed prior to the war, and almost correspond with the bare cost of the necessary raw materials in Sweden. The foreign country concerned is not specifically mentioned, although it is possible to identify it as being Germany.

Calendar.—The British Westinghouse Electric and Manufacturing Co., Ltd., has issued a wall calendar for the year ending March, 1919. Above the unobtrusive monthly date slips there is a charming portrait of a nurse.

The Swedish Volta Co.—The report of the directors of the Elektriska A.B. Volta states that the undertaking was greatly developed during 1917, and an active demand was experienced for the company's manufactures. The production, however, was hampered by the scarcity of all sorts of raw materials and machine tools, whilst the export veto introduced during the year also had a disturbing influence. Nevertheless, the home market was able to absorb the whole of the output after it had accommodated itself to existing conditions. The company's factory at Ulvsunda, which is principally concerned with the manufacture of installation material and electric heating apparatus, was greatly enlarged, and the value of the turnover was increased by over 100 per cent. The share capital has been successively increased until it now amounts to £99,000. The net profits are returned at £25,000, as compared with £6,000 in 1916, and the dividend is at the rate of 10 per cent., being the same as in the preceding year.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4.—Thirty-six page price-list (No. 10,336 A) of Mazdalux metal reflectors for the scientific lighting of factories, works, and other industrial buildings.

Messrs. Belling & Co., Montague Road, Upper Edmonton, N. 18.—New leaflet relating to their standardised electric ovens for national kitchens, and setting forth the advantages of cooking by such means.

Damard Lacquer Co., Ltd., 98, Bradford Street, Birmingham.—Circular giving particulars of their "Formite" moulding mixtures and of the process for the preparation of moulded insulation.

Moon Chart.—Messrs. C. A. Vandervell's "Moon Chart" for April contains several improvements increasing its utility and convenience of reference. As an educational device it possesses marked advantages.

Book Notices.—"Kempe's Engineer's Year-Book for 1918." 25th Edition. London: Crosby Lockwood & Son. Price 25s. net.

"New Towns After the War: an Argument for Garden Cities." By "New Townsman." London: J. M. Dent & Sons. Price 1s. net.

Trade Announcements.—Owing to a fire at their Hatton Garden premises, the Precision Works (War Materials) have removed to 27, Lots Road, Chelsea, London, S.W. 10.

The business of Schäffer & Budenberg, Ltd., has now become entirely a British undertaking, and the name of the company has been changed to "Budenberg Gauge Co., Ltd." Mr. C. F. Budenberg, M.Sc., a natural-born British subject, who has been the manager of the business for the past 29 years, and managing director since the company was incorporated in 1902, has purchased all the issued shares, and he will continue to act as managing director.

Owing to the Government having taken over their Kingsway premises, Messrs. Ernest Scott & Co., Ltd., and Messrs. George Scott & Son (London), Ltd., have taken offices at 72, Oxford Street, W. 1. Telephone Nos., "Museum 3173 and 3174."

Liquidation.—Bosch Magneto Co., Ltd., London.—April 12th is the last day for the receipt of proofs for dividend by the liquidator, Mr. H. E. Burgess, 33, Carey Street, W.C. 2.

Accumulator Manufacture in Norway.—A company has lately been formed at Kongsberg, with the title Norsk Elektrisk Accumulator Compani, to establish what, it is stated, will be the first accumulator factory in Norway.

Patent Application.—Application has been made by James Todd for restoration of Patent No. 15,593 of 1909 for "Improved fastenings for smoke-box doors of tubular boilers or the like."

LIGHTING AND POWER NOTES.

Bacup.—Price Increase.—The Corporation Electricity Committee has decided to increase the charges to consumers of electrical energy, other than those under agreement with a coal clause, as follow, from July 1st next:—Lighting, 15 per cent., making 25 per cent. on pre-war rates; power and heating, $18\frac{1}{3}$ per cent., making $33\frac{1}{3}$ per cent. on pre-war rates.

Barrow.—Loan Application.—At the T.C. meeting the Electricity Committee reported the receipt of a letter from the L.G.B. inquiring when the Council expected to be in a position to furnish it with details of its proposals for additional turbo-alternator and condensing plant, and stating that in the meantime it raised no objection to the Council proceeding with the works. It was decided to make application to the L.G.B. for sanction to the borrowing of £22,800 for electricity works purposes; £18,500 for plant and foundations; transformers, switchgear, &c., £3,100; mains, £1,200.

Blackpool.—Output.—For the past 11 months the aggregate output of the Corporation electricity works was 5,339,647 units, as against 4,895,522 in the preceding year. Private lighting, heating, and power accounted for an increase of 281,768 units.

Bury.—The Corporation has accepted a recommendation to convert the power required at the sewage works from steam to electricity.

Clydeside.—Prov. Order.—The Clyde Valley Electric Power Co. proposes to apply for a prov. order to obtain authority to raise additional capital and other powers, including exemption from attachment for fittings let by the company on hire or hire-purchase.

Continental.—Sweden.—A scheme is under consideration for the establishment of a plant at Svarta (Osterg) to utilise the water power of the Tollbro Falls in the generation of electrical energy.

Croydon.—Price Increase.—The T.C. has further advanced the price of current for lighting, heating, and power by 25 per cent., a total increase on pre-war charges of 50 per cent., as from the readings of the meters for the quarter ending March, 1918.

Derby.—Loan Application.—The T.C. has applied to the L.G.B. for the loan of £3,765 for the purchase of offices, workshops, and showrooms for the electricity department.

Dublin.—At a meeting of the Corporation, last week, a protest was entered against the taking-over of vessels by the Transport Director and Shipping Controller, and a demand was made that adequate shipping should be provided for coal supply. The Lord Mayor (Councillor L. O'Neill) said that in Dublin hundreds of small industries depended absolutely on electricity supply. Excluding public lighting, the city electrical undertaking sold in the past year 10,000,000 units, of which approximately 4,000,000 were for lighting and 6,000,000 for power. If the Government authorities reduced the coal supply by 25 per cent. he saw no prospect of preventing the disemployment of large numbers of people. Some of the restrictions which had been suggested fell exclusively on the Dublin electricity undertaking. These and the other restrictions did not appear to him to be the best solution of the coal problem, but simply the least troublesome. The hoarders and wasters of coal should be taken in hand before industrial work was touched, and sensible rationing should be introduced. A supply of 75 per cent. on last year's basis would not give the Corporation 50 per cent. for its electricity requirements. The Electricity Supply Committee has decided to connect no more consumers in the meantime, except for necessary Government work, and a proposal to cut off supplies for kinemas is under consideration, while the engineer has been asked to report as to whether economies are possible with regard to the staff. For the present it is not proposed to impose any drastic reduction in public lighting, but steps in that direction cannot be long delayed. The Tramway Co. has replied to a statement that it had "a sufficient supply of coal to run the cars for 15 months" by announcing that its stock is rapidly decreasing, and that last week it had barely sufficient to last for 28 days at the existing rate of consumption.

Gillingham (Kent).—The T.C. has decided to install at the electricity works a Diesel oil engine, with the object of providing a more efficient supply of electricity at a considerably reduced cost. On account of the adverse balance of between £3,000 and £4,000 on the electric light undertaking, the general district rate has been raised from 2s. to 2s. 6d. in the £.

Greasborough.—The U.D.C. has been in negotiation with the Rotherham Corporation as to a supply of electricity in the Council's area, and has now passed a resolution that, having considered the provisions of the Rotherham Corporation Bill now pending in Parliament and the Corporation having agreed to amend the Bill by providing that all electricity supplied by the Corporation to consumers in Greasborough under the Bill shall be supplied at the same price or prices, on the same terms, and subject to the same conditions as those upon which electricity is furnished to consumers in the borough, the Council approves the Bill as proposed to be amended and has decided to support it.

Halifax.—The Tramways and Electricity Committee has agreed to supply electricity to the Royal Infirmary at the rate of 1½d. per unit for all purposes, on condition that the infirmary enters into an agreement for seven years, that it makes the necessary connection with the Corporation terminals, and that no supply is taken between the hours of 3.30 and 5.30 p.m. in the months of November, December, and January in each year.

Haslingden.—The Lighting Committee of the Corporation is considering the question of an automatic time switching system for the electric lights between Hudrake and the borough boundary at Baxenden.

Huddersfield.—The Council has received permission from the B. of T. to discontinue the supply of electricity to certain consumers in cases of emergency.

Maidstone.—Loan Application.—The T.C. has applied to the L.G.B. for a loan of £500 for a new balancer, with the necessary switchgear.

Manchester.—Trading Profits.—The report of the Trading Profits Special Committee came in for severe criticism last week. The Committee recommended to the City Council that in future the contributions of the gas and electricity undertakings to the relief of the rates be on the basis of not less than 1 per cent. on the aggregate capital expenditure, and that the tramways should be mulcted to the extent of 5 per cent. Preceding the Council meeting the Lord Mayor received a deputation from the Manchester and Salford Trades and Labour Council and the Manchester Labour Party, on whose behalf it was urged that it was bad finance to tax certain trade departments for rate relief. Councillor M'Lachlan said the Tramways Department in 1912 had a reserve and renewals account of £450,000, but it had now been brought down to £342,000, whilst they were not keeping the rolling stock and permanent way up to date. The Council ought to aim at increasing the rateable value by assisting towards the establishment of new industries by providing cheaper electrical power. At the Council meeting several letters and resolutions of protest against the proposals were read, and it was stated that, in addition to the Trades and Labour Council, the Chamber of Commerce, the Engineers' Club, and several other representative bodies, were against the proposals. Ald. Walker, deputy chairman of the Electricity Committee, voiced the general opposition, and declared that the Council had no right to define a policy of that kind for future years. It was its duty to attract industrial concerns to the city, and the great need was a cheap and ample supply of electricity. Ald. Johnston said the Tramways Committee ought to be preparing for the large expenditure it would have to incur, and Councillor Fox said the permanent way required renewing practically all over the city. The Manchester tramways had been a success, but methods such as these would ruin it. An amendment referring the report back was lost, and the report was finally approved by 51 votes to 36, Ald. Goldschmidt, chairman of the Finance Committee, saying the alternative was 10d. in the £ on the rates.

War Bonus.—The Committee on Production has granted an application from the Joint Workers' Committee of the Corporation for a 12½ per cent. bonus on the present wages of men in the electricity and tramway sheds departments. The bonus applies only to workers of 21 years and over, and dates from February 28th last.

Mansfield.—Loan Application.—The L.G.B. has refused the application of the T.C. for a loan of £20.000 for electricity purposes.

Power Co.'s Bill.—At a meeting of the Gloucester City Council, the General Purposes Committee reported that the Mayor (Sir James Bruton) and the electrical engineer and the town clerk attended a conference of opposing local authorities, on March 20th, when provisional arrangements were made for opposing the Gloucestershire Electric Power Bill in Committee. The Mayor, High Sheriff, Ald. Langley-Smith, and Councillor Fielding were appointed a Sub-Committee, with power to act.

Redruth.—Proposed Price Increase.—The Urban Electric Supply Co., Ltd., has informed the U.D.C. that it has applied to the B. of T. for consent to increase the maximum price of current to 9d. per unit, undertaking not to charge more than 8d. per unit without the consent of the Council, which should not be unreasonably refused. The Council has decided to ask the B. of T. for an inquiry, if one can be made without expense to the Council.

Rotherham.—Price Increase.—The electricity department has given notice that the charges for electricity for industrial power will be increased by a further 13⅓ per cent. for all energy consumers during the quarter commencing April 1st, 1918, and until further notice.

Southport.—Price Increase.—The Corporation Electricity department has advanced the price of current for all purposes by ½d. per unit, in addition to the advance of 20 per cent. above pre-war charges.

Stoke-on-Trent.—Price Increase.—The Electricity Committee has decided to make a further increase of 20 per cent. in the charges for electricity, thus making the total increase 60 per cent. since the outbreak of war.

Tasmania.—Plant Extension.—The Launceston City Council, Tasmania, has decided to increase the supply of water power for electrical purposes in order to provide an additional 400 kw. for a new factory. For this purpose a flume or race is to be constructed from the tunnel inlet, South Esk River, to the power station. The Electric Light Commissioner has been empowered to purchase in Australia any necessary additional plant for the scheme.—*Commonwealth Engineer.*

Todmorden.—In his annual financial statement to the T.C., last week, Alderman Wm. Ormerod said there was an estimated deficiency of £2,500 on the electricity undertaking, but a scheme was on foot for the provision of new and up-to-date plant, which it was hoped would convert the department into a remunerative one.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—At a meeting of the Tramways Committee, last week, it was decided to ask the Council, owing to the recent decision to give the 12½ per cent. bonus to motormen and other employés of the traffic department, to apply to the Board of Trade for sanction to vary the present statutory obligations. The 1d. stage now extends to two miles, and application will be made for permission to reduce that distance.

Blackpool.—Year's Working.—The Corporation tramways total receipts, with over a fortnight to complete the year, are £109,027, and it is estimated they will reach £120.000, as compared with £94,000 last year. Nearly 19½ million people have been carried, an increase of 3½ millions, and the average receipts per car-mile are 1s. 9¾d., as against 1s. 8d. last year.

Bolton.—The Finance Committee is requesting the Tramways Committee to provide £15,500 towards the relief of rates during the coming year. This is the only department which is expected to be profit-making. Rate-aid grants from trading departments in 1915-16 amounted to £31,600.

Colne.—The Tramways Committee has decided to apply to the B. of T. for permission to proceed immediately with the repairs and renewals of the permanent way, crossings, and rolling stock of the department.

Cork.—The management of the Cork Electric Tramways states that, owing to the coal supply difficulty, there is a prospect of the service being considerably curtailed, if not entirely suspended. Fears are entertained in various of the Irish provincial cities and towns that it may be necessary to reduce the electricity supply for all purposes.

Darlington.—Included in the estimates for the year is a profit of about £500 on the tramway undertaking.

Darwen.—Wages Increase.—The General Purposes Committee has decided to abide by the award of the arbitrator, and pay the increased wages to the tramway workers. It has also been decided to rescind the resolution offering an advance of 16s. per week on pre-war wages to skilled men at the electricity, &c., works, and 12s. to other employés, and to offer 14s. per week all round.

Doncaster.—For a fortnight the town has been without tramway cars, owing to a strike of the Corporation's workmen. It was decided to refer the matter to an arbitrator, and the men will resume work in the meantime.—*The Times.*

Dublin.—At a mass meeting of the employés of the Dublin United Electric Tramways Co., Mr. R. Williams, secretary, Transport Workers' Federation, intimated that the Ministry of Labour had informed him that the application for the extension of the national award to Dublin tramwaymen was being referred to the Committee of Production, and, in the circumstances, work proceeded as usual.

Glasgow.—At the recommendation of the Finance Sub-Committee, the Tramways Committee of the T.C. is to consider the advisability of rescinding a resolution passed by the T.C. recently, postponing action in the matter of finance until the end of the departmental year on May 31st. The proposal has been prompted by altered circumstances and increased expenditure. There are two methods by which the income may be augmented, and both necessitate the abolition of the halfpenny fare. One is by raising all fares by a halfpenny, and making the penny the minimum fare, while the other is a rearrangement of the present scale, so that a person would travel three stages—equal to three half miles—for a penny, instead of four as at present, six stages for twopence, and so on.

Gloucester.—At the last meeting of the City Council, Sir James Bruton stated that no additional sum was required from the rates in respect of the light railways. The revenue estimate was £23,000 against £20,000 for the year. That was owing to the increase in the fares. He believed that if they could have obtained that increase a few years ago, when affairs were normal, the sum derived would have been sufficient to cover the interest and repayments of loan, and there would have been no charge on the city for the tramways.

Halifax.—New By-law.—The Tramways Committee has decided to recommend the Council to agree to the following new by-law :—"Each (tramway) passenger shall immediately upon demand, and in case no demand shall have been made before leaving the car, pay to the conductor or other duly authorised officer of the Corporation the fare legally demandable for his journey and accept a ticket therefor, or if the carriage is provided with a money box for the receipt of fares, each passenger shall immediately on entering the carriage, or when required, deposit in the money box the fare legally payable for the journey. Any passenger leaving a car, except in the case of a passenger holding a transfer ticket changing cars at the recognised transfer point, shall be deemed to have completed his journey."

Lancashire and Yorkshire Railway.—The conversion of the Bury and Holcombe Brook branch of the Lancashire and Yorkshire Railway from the overhead to the third-rail system is nearing completion, and it is anticipated that trains will be running under the new system early this month. The third-rail electric system is in operation between Bury and Manchester, and the alteration will permit through running from Manchester to Holcombe Brook.

Leeds.—Parcel Rates.—The rates for the new tramway parcel-carrying service have now been fixed as follows :—Between depôts within the city, for any parcel not exceeding 7 lb., 2½d. ; exceeding 7 lb., and not exceeding 14 lb., 3½d. ; depôts within the city, for any parcel exceeding 28 lb., and not exceeding 56 lb., 6d. ; between depôts outside the city and depôts within the city, for each parcel, irrespective of weight, an additional 1d. will be charged.

Oldham.—Year's Working.—The financial year of the Corporation tramways ended on March 25th. The total receipts during the year ending March, 1917, were £124,928, and for the year ending last month, £148,026, an increase of £23,098.

The Tramways Committee has appointed a Sub-Committee to consider the revision of fares. Councillor Clegg, the chairman, said expenses amounted to £30,000 a year more. The last war bonus cost them £6,700, and by the end of 1919 they would have to find an increase of £11,300 over their present receipts. They had to find that money, or come on the rates for £7,000. On the present year they would have a surplus of about £5,000, but the whole of that amount ought to be set aside for permanent way or overhead equipment. Had the ordinary work been carried out they would have already shown a loss.

Rawtenstall.—Fares to be Increased.—The T.C. has decided that £3,000 for tramway purposes be included in the estimate for the borough rate for the coming year. The borough electrical engineer had intimated that the increased capital expenditure over pre-war times was £16,000 per year, and the increased revenue did not meet the increased expenditure. It was resolved that representation be made to the B. of T. that the finances of the tramway undertaking cannot possibly withstand the advances under the recent award made by the Committee on Production, unless it sanctions a large increase in tramway fares, and that the borough electrical and tramway engineer be instructed to communicate with the B. of T. Committee accordingly.

Southport.—The Corporation has commenced the Sunday tramcar service, despite many protests. The voting on the question, taken by the local Council of Churches, showed 5,998 in favour, and 5,430 against. In Southport itself there was a small majority against the proposal. The Tramways Committee has granted employés an advance of £1 per week on pre-war rates, a previous offer of 16s. a week having been declined by the men.

Spen Valley.—Fares Increased.—The Yorkshire W.D. Electric Tramways, Ltd., in the Spen Valley area, has increased its fares at the rate of 1d. per two ½-mile sections, or less. Workmen's and children's fares are not affected. The increase came into force on Good Friday.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—An agreement between the Department of the Navy and the Radio-Telegraphists' Marine Institute of Australasia, covering the wireless operators, has been brought about. Substantial increases in pay will accrue to the wireless men ; in addition, a 10 per cent. war bonus has been granted, and the Seamen's Compensation Act will apply. The latter provides for £500 at death.—*Sydney Daily Telegraph.*

The use of automatic telephone recorders, which has been allowed to subscribers on payment of 10s. a year, to check the number of calls, is to be discontinued. The department has come to the conclusion that they do not work satisfactorily.—*Sydney Morning Herald.*

The annual report of the Post Office Depatrment shows that for the first time a profit was made on the telephone business, amounting to £17,234. In the previous year the loss on telephones was £138,843. The telegraph business, however, resulted in a loss of £25,483. If credit had been taken for shipping and meteorological telegrams there would have been a profit of £48,589 on the telegraph branch, instead of a heavy loss.

The telegrams received and dispatched during the year numbered 32,850,649. There were 169,941 telephone subscribers, 4,283 public telephones, and 3,513 local instruments.

It is expected that Sydney will have its first automatic telephone exchange early next year. The tender of Automatic Telephones (Australasia), Ltd., has been accepted for a full automatic switchboard, having a present equipment of 2,500 subscribers' lines and the necessary junction lines. Tenders are now being called for the building to accommodate this exchange.

Germany.—Negotiations are reported to have been proceeding for some time past with the object of bringing about an agreement between the two wireless concerns—the Telefunken and the High-Frequency Co.—in regard to the future development of their undertakings. So far, however, no final result has been reached.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—April 9th. Electricity Department. One 5,000-kw. turbo-alternator, surface condenser, and auxiliaries. See "Official Notices" March 22nd.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Spain.—The municipal authorities of Esguevillas (Province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of two years.

Spenborough.—April 10th. District Council. Works required for extensions at electricity works. Engineer, Mr. A. Rothera, M.I.M.C.E., Town Hall. (Plans three guineas for complete set of quantities, or one guinea for separate trades, returnable.)

CLOSED.

Australia.—Melbourne.—P.M.G.'s Department :—

Telephone material for automatic private branch exchange G.P.O., £229.—Automatic Telephones (Aust.), Ltd.

Sydney.—P.M.G.'s Department :—

940 lb. ebonite sheet, £306 ; 412 lb. enamelled insulated copper wire, £132. B.I. & Helsby Cables, Ltd.
Full automatic switchboard at the Telephone Exchange, N. Sydney, £61,600 ; 2,100 wall sets, £6,405 ; 258 table sets, £871 ; 40 meter boxes, £100 ; 15 pay station boxes, £90 ; 118 calling devices, £165 ; miscellaneous materials for junctions at manual exchanges, £223.—Automatic Telephones (Aust.), Ltd.

Perth.—P.M.G.'s Department :—

1,000 dry cells, £225. J. McIlwraith & Co., Pty. Ltd.
300 calling dials, 200 condensers, and 25 transmitters, £504.—Automatic Telephones (Aust.), Ltd.

Victoria Railways Department :—

Spare parts for electric crane motors for Ballarat and Bendigo works, £562.—Australian General Electric Co.

—Tenders.

Cavan.—The B. of G. has accepted the tender of the Edmundson's Electricity Corporation, Dublin, for installation of an electric battery in the workhouse, at £391 ; overhead mains, &c., £615, and overhead main to tuberculosis hospital, £128—£1,134 in all.

Derby.—Electricity Committee. Accepted tenders :—

Babcock & Wilcox, Ltd. Induced-draught fan, motor, main damper, &c., £805.
Chain Belt Engineering Co.—Ash elevator and bunker, £950.
British Thomson-Houston Co., Ltd.—Switchgear for 4,000-kw. turbine, two feeder panels, interconnection switchgear, &c., £2,924.
E. Morley & Sons.—Power station extensions, £4,555.
W. Abell, Ltd.—Penstocks and headstocks for screening chamber, £320.

Glasgow.—The Tramways Committee has accepted the following tenders :—

Rail bonds.—Thos. Bolton & Sons.
Glass.—Pilkington Bros., Ltd.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Saturday, April 6th. At the Tavistock Hotel. At 3 p.m. Ordinary meeting.

Salford Technical and Engineering Association.—Saturday, April 6th. At 7 p.m. At the Royal Technical Institute. Paper on "The Use of Gas for Industrial Purposes," by Mr. S. N. Brayshaw.

Electrical Power Engineers' Association (London Division.).—Monday, April 8th. At 6.30 p.m. At Anderton's Hotel, Fleet Street, E.C. Smoking concert and presentation to Mr. W. J. Ebben.

Institution of Civil Engineers.—Tuesday, April 9th. At Gt. George Street, S.W. At 5.30 p.m. Paper on "The Derwent Valley Waterworks," by Mr. E. Sandeman.

Rontgen Society.—Tuesday, April 9th. At 8 p.m. At Burlington House, W. Silvanus Thompson Memorial Lecture, by Sir Ernest Rutherford, F.R.S.

Liverpool Engineering Society.—Wednesday, April 10th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Bonus Payments to Labour as a Factor in Engineering Production," by Mr. R. J. Fisher.

Institution of Electrical Engineers.—Thursday, April 11th. At 7.30 p.m. At the Cancer Hospital, Fulham Road, S.W. Joint meeting with the Electrical Section of the Royal Society of Medicine. Papers on "Diathermy: the use of Electricity for Heating the Tissues of the Body in Disease," by Dr. E. P. Cumberbatch; "Single Flash (Instantaneous) Radiography: its Possibilities and Limitations," by Dr. R. Knox. Also exhibition of electromedical apparatus.

(**Newcastle Local Section**).—Monday, April 8th. At the Mining Institute. At 6.45 p.m. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(**Manchester Local Section**).—Tuesday, April 9th. At the Engineers' Club. At 7 p.m. Ordinary meeting. Annual general meeting.

(**Scottish Local Section**).—Tuesday, April 9th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Control of Large Amounts of Power," by Mr. E. B. Wedmore.

(**Yorkshire Local Section**).—Tuesday, April 9th. At 7 p.m. At the Philosophical Hall, Leeds. Annual general meeting.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 13th. At 2 p.m. At the Neville Hall, Newcastle-on-Tyne. General meeting.

NOTES.

Electrical Power Engineers' Association.—A local West Yorkshire branch of the Association was formed at Leeds last week. The meeting was held under the presidency of Mr. J. E. Ellis, Morley. The following officers were elected :—Hon. branch secretary, Mr. P. Furness, A.M.I.E.E., 6, Ash Grove, Earlesheaton: hon. treasurer, Mr. R. D. Spurr, A.M.I.E.E., Bradford. The Committee will elect a branch chairman from its members. The meeting was largely attended, and the enthusiasm shown augurs well for the success of the new branch.

Dublin Electricians' Wages.—In the Dublin building trades' wages settlement, announced this week, the scale for electricians has been fixed at 1s. 1½d. per hour, summer, and 1s. 1¾d. per hour, winter, while for country work the allowances fixed are :—2s. 6d. per night for six nights, and 2s. per night, for any further period.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending April 14th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Darley Bentley.

Next for Duty.—Capt. E. G. Fleming.

Monday, April 8th. No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, April 9th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, April 10th.—No. 1 Company, Drill, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, April 11th.—No. 2 Company, Drill, Knotting, &c., 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, April 12th.—Musketry, 5.30—8.

Saturday, April 13th.—Entrenchments, &c., 2.45—4.45. Recruits' Drill, 2.45—4.45.

Sunday, April 14th.—Commandant's Parade at Waterloo Station, 8.45 a.m. for work at Esher. Marching order, with rifles. Mid-day and tea rations to be carried.

Special Notices.—All drills will be held at Headquarters unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

A 35,000-KW. Turbine Wrecked.—On February 14th the 35,000-KW. horizontal single-cylinder steam turbine in the O Street Station of the Boston Elevated Railways Co. exploded, so completely wrecking the machine that it will be sold for junk as it stands. Fortunately no one was killed or injured. The trouble developed in the low-pressure stages—the 17th, it is believed. All diaphragms and wheels, together with the blades from this stage to the 20th, were fractured and broken in many pieces, and released with such force as to smash away the whole top half of the low-pressure end of the casing.

The initial cause of the accident is thought to be due to excessive steam pressure between the diaphragm and the 17th wheel, concaving the diaphragm, causing it to foul the wheel, closing up the buckets and, in this way increasing the steam pressure at this point until the next diaphragm was similarly affected, when the whole low-pressure end let go.

The accident occurred at a time when engines in another station of the Railways Co. dropped their load of 27,500 KW. Presumably, the wrecked turbine tried to take all of this load, opening its secondary valve to get all the high-pressure steam available.—*Power.*

Electric Power Supply and After-War Industry.—The following resolution of the Newcastle Chamber of Commerce has been placed on the agenda for discussion at the annual general meeting of the Chambers of Commerce next week :—

"This Association, recognising the urgent necessity to increase the productivity of our industries after the war as the chief means to meet the burden of the war debt of the nation, and to maintain high wages for the workers, urges His Majesty's Government:

(*a*) To recognise that the public supply of electrical energy for power, light, traction, heat, electrochemical and other purposes, is a key industry, insomuch that all other industries are becoming increasingly dependent upon it.

(*b*) To hasten the amendment of the legislation which has hitherto hampered its efficient development.

(*c*) To ensure the supply at the earliest possible date of ample and cheap electricity for all purposes.

(*d*) To conserve our coal resources, the chief wealth of the country, by compelling the exercise of the maximum possible economy in its use for industrial, domestic and all other purposes.

and agrees that this resolution be communicated to the Prime Minister, the President of the Board of Trade, and the Minister of Reconstruction."

Relaying Old Cable.—Indications that it is practicable to remove cable from places where it has been in service, and to re-install it in new positions, are given by the fact that the street department of the Commonwealth Edison Co., Chicago, is moving about 75 miles (120·7 km.) of cable from one location to another on its system. About 70 per cent. of the cable being moved is three-conductor, paper-insulated, lead-covered transmission cable which operates at 9,000, 12,000 or 20,000 volts, and at either 25 or 60 cycles. The remainder is four-conductor distribution-line cable for 4,100-volt, three-phase, 60-cycle circuits.

Some engineers are still prejudiced against using, under any circumstances, cable that has been withdrawn from the conduits. Other engineers will not use cable under such conditions unless it is placed in service at a lower voltage than that at which it was originally used. All such ideas have been gradually eliminated at Chicago, largely by the persistent arguments of the men who were most closely in touch with the work, and by trials made during the past few years.

The contention of the men in the street department is that, as long as the lead sheath remains intact, and the insulation of the cable shows no signs of being damaged, either by overheating or in any other manner, the cable is in condition to be utilised again after it has been drawn from the conduits. Damage to the insulation by overheating or by moisture, or to the lead sheath by cracking, &c., can be easily detected by the men handling the cable if they are on the watch for defects. Moreover, the company's engineers have no prejudice against using the cable on even a higher voltage than the original, if they think that the cable is adapted for service at this voltage.

One of the problems in connection with the transfer of this 75 miles of cable is to keep the wastage at a minimum. A system of record keeping has been worked out which is very helpful in solving this difficulty. This system permits lengths of cable from various parts of the system to be selected and re-installed at such new locations as will best utilise the lengths available. The system employed also makes it possible to keep the necessary haulage expense at a minimum, since the cable goes directly from its original location to its new location without extra unloading or transfer.

To reduce wastage further, splices are being pulled into the ducts. It is the practice in such cases to select a long and a short piece of cable for splicing to the desired length. The longer piece is pulled into the duct until only enough remains outside the manhole to facilitate splicing. The splice is then made on the street level above the manhole, and the splice and shorter piece are pulled in. This procedure, of course, reduces the tensile strain on the splice. About 12 such high-tension splices are now operating satisfactorily. Wire grips are used for pulling cables in and out, and it is the rule never to have more than one splice per run.

The company's records to date, with the work about one-third completed, indicate that the wastage of cable is not more than 2 per cent. above the ordinary wastage due to cutting off each length. As the work draws nearer to a finish it is expected that the wastage will increase to 3 per cent. or 4 per cent., since near the end of the job there will be fewer lengths to choose from. If new cable had been used the increase in cost to the Commonwealth Edison Co. would have been upwards of $200,000.—*Electrical World*, Vol. 70, No. 10.

Electrical Progress in Chicago.—Statistics compiled by the contract department of the Commonwealth Edison Co. of Chicago show that during 1917 more industrial power business was secured than in any other year of the company's history, the net increase being 58,000 H.P., a gain of about 10 per cent. over 1916 and over 100 per cent. over 1915. Including the lighting load of these power installations, the total net increase was approximately 65,000 H.P. The business was covered by 2,665 contracts, as against 3,100 for 1916. Satisfactory progress was made in the use of electric furnaces, two companies engaging in the manufacture of electric steel, one in that of bearing metal, and one in that of brass founding.

An interesting extension was in the manufacture of artificial ice in 26 plants with a connected load of 9,000 H.P., requiring approximately 25,000,000 KW.-hours.

In the electric truck business development is especially noticeable. The company has completed a large commercial garage, and is offering maintenance service.

While there has been a decrease of 0·07 per cent. in the number of motors sold, the increase in total H.P. is 30 per cent.—*National Electric Light Association Bulletin.*

Lighting and Power Restrictions.—The Board of Trade Lighting, Heating, and Power Order, 1918. appears in its complete form in the *London Gazette* for March 29th.

Electrical Cleaning of Blast-Furnace Gas.—In the *Iron and Coal Trades Review*, of February 22nd, an article by H. D. Egbert, of the United States Research Corporation, was printed. The author referred to a paper by Messrs. Linn Bradley, H. D. Egbert, and W. W. Strong, entitled "Dry-Hot *versus* Cold-Wet Blast-Furnace Gas Cleaning," read before the American Institute of Mining Engineers, in which calculations are described and curves presented showing the saving of heat that can be accomplished by the hot-dry cleaning of blast-furnace gases as compared with cold-wet methods. In the case of a typical blast-furnace top gas having a moisture content of 25 grains per cb. ft. calculated at standard conditions, and a temperature at the entrance to the primary cleaning system of 500° F., it can be shown that by the use of a hot-dry cleaning method as compared to a cold-wet process, about 110 B.TH.U. per lb. of top gas can be saved and applied to useful work in the hot-blast stoves. Moreover, in some places large quantities of water for wet scrubbers are difficult and expensive to obtain, also the resultant pollution of the near-by streams due to the inflow of dirty water from the scrubbers is, in many cases, prohibited by the authorities. Because of the above facts it has been recognised that the hot-dry primary cleaning of blast-furnace gas is very desirable, and considerable attention has been directed of late to the Cottrell electrical precipitation process as offering a most satisfactory means of hot-dry primary gas cleaning. Interest in the use of the Cottrell processes as a means of cleaning the blast-furnace gas has been further augmented by the fact that the dust and fumes carried by these gases often contain valuable materials, especially potash.

It will be evident that a hot-dry method is decidedly preferable to a cold-wet method of blast-furnace gas cleaning when the question of the recovery of the dust and fumes is under consideration. The difficulty of handling large amounts of water and sludge from wet washing systems, and the trouble incidental to recovering therefrom the valuable potash compounds, will at once be evident. During the past 18 months the Research Corporation in the United States has been conducting more or less continuously a series of tests with the Cottrell precipitation processes at a large iron and steel plant. These tests have conclusively demonstrated that electrical precipitation can be successfully applied to the cleaning of blast-furnace gas, and have further yielded a mass of data upon which to base the design of a large precipitation plant for handling all the gases from one furnace, or a considerable portion of such gases. The precipitator with which these experiments were made was capable of handling up to about 3 per cent. of the total volume of gas given off by one 500-ton furnace, or about 2,400 cb. ft. of gas per minute at 300° F. It was found possible to clean the gas in one treatment in an electrical precipitator, from a dust content of 3 grs. per cb. ft. to a dust content as low as 0·05 gr. per cb. ft., both calculated at standard conditions. The collected dust and fumes showed over 10 per cent. available potash content.

The power required to operate a precipitator is small; a precipitator to clean 10,000 cb. ft. of gas per minute will usually require from 7 to 10 KW. The power consumption is governed by the number of electrodes and their length, type, and size, as well as by the characteristics of the gases to be cleaned, as regards temperature, conductivity, &c.

During the last year or two a high-pressure, direct-current generator has been successfully adapted to precipitation work. Although no precipitation installations at present in commercial operation are equipped with this machine, nevertheless it has been extensively tested by the Research Corporation in connection with the Cottrell processes, and has proved very satisfactory.

Some idea of the cost of the electrical equipment may be obtained from the following figures:—A set having a capacity of 10 KW., giving a maximum pressure of 75,000 volts, and consisting of a transformer, synchronous motor, rectifier, and switchboard, may be obtained for about £350. If a motor-generator set were required, an equipment of the same capacity would cost about £450. The larger the power rating of the transformers and motor-generator units the lower is the cost per KW. of capacity. This is especially true with regard to the transformer, as a great deal of its cost is due to the insulation against the high voltage. The difficulties involved in continuously rectifying heavy currents make it advisable to keep the power capacity of the electrical sets down to a reasonable figure, and in practice equipments over 25 KW. capacity are seldom used.

Electric Steel Furnaces.—In the *National Electric Light Association Bulletin* Norman T. Wilcox, sales manager of the Mississippi River Power Co., at a meeting of the Western Society of Engineers, is reported to have said that outside of the steel trade few people appreciate the rapid growth in the use of electric furnaces.

This growth has resulted from the efficiency of electric power, and has for the most part occurred within the last five years, the greater portion of the increase occurring in the last year or two.

Up to March 1st, 1917, at least 158 steel-making electric furnaces had been contracted for, or were at that time in actual commercial service, in the United States. These furnaces if operated 24 hours a day, six days in a week, would have a total capacity of 1,000,000 tons of steel per annum. The production of a million tons of steel made from cold scrap would represent at least 600,000,000 KW.-hours per annum.

Because of its uniformity, greater freedom from segregation, and its greater homogeneity, electric steel is somewhat higher in tensile strength and elastic limit than steel made by other processes. Owing to its greater density the electric steel shows a marked resistance to fatigue.

Small furnaces have been developed even in the polyphase type down to capacities as low as ½ ton of metal per heat. A furnace of this size will require from 100 to 125 KW., and when operated polyphase will run on a power factor of approximately 90 per cent. The larger furnaces as now installed require for most efficient operation approximately 250 KW. ton of metal per heat.

Electric furnaces cannot be expected to take the place of the ordinary cupola, such as is used for the making of common grades of cast-iron, but they are the only apparatus which will successfully produce all grades of material from and in the same furnace. These products range from superior quality cast and malleable iron to the finest grades of crucible and tool steels.

An Association of British Electrical Engineers: Electricity Supply Section.—A preliminary Committee, consisting of Messrs. L. L. Robinson (chairman), Hackney, president of Associated Municipal Electrical Engineers (Greater London); E. Calvert, Finchley, hon. secretary of Associated Municipal Electrical Engineers (Greater London); A. P. MacAlister (hon. secretary), Islington, hon. secretary of Chief Technical Assistants' Association; H. Faraday Proctor, Bristol, hon. secretary of Incorporated Municipal Engineers' Association; F. J. Walker, St. James' and Pall Mall Co., managing director; A. C. Bostel, Croydon, president of Electrical Power Station Engineers; and E. D. Napier, North Metropolitan Electric Supply Co., Willesden, has been considering the desirability of forming an Association of British Electrical Engineers, Electricity Supply Section.

The members of the above Committee, who hold official positions in the I.M.E.A., A.M.E.E. (G.L.), &c., are acting in their personal capacities and quite unofficially, but are doing so with the full approval of the Councils of the Associations which they represent.

After drafting preliminary objects and Articles of Association, the Committee interviewed the President of the Institution of Electrical Engineers, who has given the project his hearty support.

The primary project of this Section of the Association is to safeguard the interests of all professional and technical men engaged in the electricity supply industry; but it is hoped that similar sections may be formed for those engaged in other branches of the electrical industries of Great Britain, each with its own Council, which will be represented on a Grand Council which will focus the activities of all engineers engaged in the electrical industries of the United Kingdom.

The Association will be in no sense a Trade Union, but will be constructed rather on the lines of the existing professional Associations such as, for instance, the British Medical Association.

The proposal to form this new Association was recently discussed by the Council of the Institution of Electrical Engineers, which has appointed a special Vice-Presidents' Committee to meet the members of the Preliminary Committee referred to above, and has agreed to call together mass meetings of professional and technical men engaged in the business of electricity supply throughout the country. Such meetings will be called both in London and at the Local Sections. At these meetings the project will be fully discussed, and a permanent executive will be appointed, charged with the duty of giving effect to the proposed formation of the Association.

Fatalities.—James Hall (16), of Manchester, was caught in some machinery, on March 23rd, at the L. and Y. electricity works, Newton Heath, and was so badly injured that he died on the following day in the Ancoats Hospital. He was doing voluntary work in his course of training as an engineer.

An inquest was held at Tipton (Staffordshire), concerning the death of Alfred Tearne (17), who was employed by the Midland Expanded Metal Co. The evidence showed that he was heard to cry for help, and that he was found clinging to a guide-wire stay in connection with the electric installation. He was practically in a sitting position with the wire between his legs, and he died shortly afterwards. Cyril Walton, electrician at the works, said he had made exhaustive tests with a machine, and failed to detect any escape of current. The nearest "live" wire to the guide-wire would be 4 to 5 in., and, in his opinion, it would be impossible for the latter to come into contact with it. Dr. Hudson said there was no trace of disease in the body, and there was no definite indication of the cause of death. However, the congested condition of the brain and the fluidity of the blood pointed to death from electric shock. The Coroner said the jury was placed in the position of having to reject the evidence of either the doctor or the electrician, and he proposed to adjourn the inquiry, and invite a Home Office expert to examine the place.

The I.M.E.A. and the Report on National Electricity Supply.—South Shields Electricity Committee has considered the remarks of its electrical engineer on the statement of the Council of the I.M.E.A. on the subject of national electricity supply. The Committee is of opinion that the statement is practically an endorsement of the interim report of the Coal Conservation Sub-Committte, and that the Council of the I.M.E.A. has prejudiced the interests of certain undertakings, particularly those on the North-East Coast. It is held that many of the statements in the report, if not actually incorrect, are, at any rate, misleading.

The Committee has asked the borough electrical engineer to convey these views to the I.M.E.A., and has decided that the municipal undertakings on the North-East Coast be asked to protest against the action of the I.M.E.A. and to call a general meeting to discuss the matter.

Water Power in Tasmania.—"When the electrolytic zinc works at Risden," says Mr. J. H. Butters, the chief engineer and manager of the Hydro-Electric Department of Tasmania, "are ready to take their first instalment of electrical energy—4,000 H.P. —which will be in a few months, the Tasmanian hydro-electric scheme will be loaded up to its full present capacity of 10,000 H.P. We are preparing to increase the capacity to 30,000 H.P., but just at present it is impossible to secure the material for the steel pipe-line. . . . The surveys relating to the proposal to harness the King River to supply the 20,000 H.P. which the Mount Lyell Co. desires to use in the work of treating the complex zinciferous ores of the Read-Rosebery group have been completed. The designs for the work are now being drawn up, and will be submitted to the State Parliament during the coming session."

Decimal Coinage.—At the annual meeting of the Association of Chambers of Commerce to be held in London on Tuesday and Wednesday next, a Bill for providing a decimal system of coinage will be submitted for approval. The terms of the Bill have been agreed on by the Executive Council of the Association, the Bankers' Institute, and the Decimal Association. Arrangements are being made for its immediate introduction in the House of Lords.—*The Times*.

Electric Welding Repairs.—A paper, read by Commander E. P. Jessop, of the U.S. Navy, before the American Society of Naval Engineers, and reprinted in *Engineering*, describes the injuries inflicted upon the machinery of the interned German vessels by their crews, with the intention of rendering them useless to the Allies, and the methods adopted for their repair. It is curious to read that, while the rapid repair of these vessels was of the utmost importance, and our American cousins possess a high reputation for the absorption of new ideas and the adoption of speedy methods, the most obstinate and determined opposition was manifested to the employment of electric welding on the cylinders and other damaged parts of the ships' engines, by marine engineers who recommended the renewal of all cylinders that were badly damaged. Fortunately, the Collector of Customs had appointed a Board of Railway Engineers to investigate the damage, with a view to the use of electric welding—railway engineers being chosen because they were thoroughly familiar with the use of electric welding in connection with cast-iron; and this Board unanimously stated that all the damaged cylinders could be reclaimed. In the face of strenuous obstruction, the Board carried its point, and 15 ships were successfully repaired, all of which were put in commission with no more delay than would have been incurred in any case in fitting them for use as transports if the main machinery had not been damaged by the Germans.

In order to weld successfully with the electric arc, says Commander Jessop, it is necessary to have complete control of the current. The arc must be directed along the line of fracture to be welded. Welding must be done slowly, the metal being laid on layer by layer, and each layer must be caulked and peened to knock or chip out the metal that has oxidised or hardened. Cast-iron is not welded to cast-iron direct. Special alloy steel wire is used to supply the welding metal. In welding two cast-iron edges together a layer of steel is welded to each, and then these steel layers are welded to each other. It is difficult to weld two cast-iron parts together, but comparatively easy to weld a steel piece to a cast-iron piece.

The advantage of electric welding is that the work can be done without preheating the parts and without removing the parts from the ship (provided the electric arc can be properly directed along the fracture).

The details of the various repair jobs that were carried out are extremely interesting; they included welding inserts into cylinders and liners, welding on steam nozzles to the cylinders, &c. Bent piston rods, broken cylinder covers, and other classes of sabotage also were dealt with, but not necessarily by welding. It appears from the author's remarks that the marine engineering practice of the Germans is in many respects inferior and slipshod, but the electrical equipment of the huge *Vaterland* was of the latest type, and in some features superior to United States practice.

In summing up the subject, Commander Jessop says that in welding cast-iron it is particularly essential that the welding metal be laid on the cast-iron surface with the greatest care, since it is the junction between the cast-iron and the welding metal which is liable to be inferior. To accomplish this the welding metal should be laid over the cast-iron surface wherever possible before the patches are put in place. This method gives the welder more room to work, and permits him to keep a steadier arc, and thus reduce the probability of too much or too little heat spoiling that part of the weld. This metal as it is laid on the cast-iron surface must then be peened by a caulking tool in order to develop any hard spots or spots where contact is not good. After this part of the operation is completed the patches should be put in place, and the completion of the weld then is merely welding of steel to steel, which is a very simple process.

In all the work which has been undertaken by the electric welders there has never been a failure, this in face of the fact that almost every conceivable kind of patch has been handled, and also in face of the fact that the work has been very much more extensive than any ever before attempted. This is practically the first job of its kind of any moment to be attempted in marine engineering. In every case in which this method has been used the repaired job has been fully as strong as ever it was before the damage was committed, and in most cases stronger in the particular part affected.

Naval Constructor H. G. Knox also gives particulars of the welding repairs on three German ships; out of 24 cylinders, 17 were damaged and 15 required welding, some by acetylene others by the electric arc.

The Electric Gun Again.—The long-range gun with which the Germans, who are fond of futilities, have been tormenting the Parisians, has attracted a great deal of attention in the lay Press, and has been the subject of much speculative comment, inspired rather by lively imagination than by logical reasoning on the basis of known facts and the elementary laws of dynamics.

The *Daily Express* seized the opportunity to resurrect the Bachelet bubble, which we pricked in 1914, and solemnly stated that an electric gun on the "Bachelet system" would be at least 200 ft. long, to fire 75 miles, and would require "only 300 H.P. of electricity" to fire it, producing a muzzle velocity of five miles a second. Prodigious! It also quoted some experiments of the late Prof. Birkeland suggesting a possible range of 1,000 miles. We should hardly have thought it possible that any respectable journal could print such nonsense.

The *Evening Standard* published an article in which the Bachelet idea was pilloried, unfortunately on erroneous premises, but the electric gun upheld on equally mistaken grounds; actually, the gyroscope was dragged in as a means "by which the *trajectory* of the missile would be maintained"! (our italics). We are informed that "it will be obvious, however, that to the extent that a body attains velocity it loses weight (overcomes gravity)" and we need not follow this writer further into the realms of fancy, merely noting that after his name are printed the letters "F.A.S., D.A.," to which the reader may attach his own interpretation. *The Times*, however, and *Nature* printed articles by Sir George Greenhill, in which the subject was discussed with expert knowledge—and therefore without any reference to electric propulsion.

It is almost exactly ten years since we showed, with a most elementary calculation, the utter absurdity of attempting to rival the propulsive power of explosives by electric power. A first-year student at any technical school could easily show that to impart a muzzle velocity of 5,000 ft. per second to a shell of 300 lb. weight requires 117 million ft.-lb. of energy, and if the "gun" is 100 ft. long, the average horse-power that must be expended with 100 per cent. efficiency is over 5,000,000. "'Nuff said!"

New Coal Mines Regulations.—A circular issued by the Coal Controller under the Defence of the Realm Act forbids, amongst other things, the erection or acquisition of any additional buildings, plant, or machinery not strictly required for the purposes of repair or maintenance, without previous written notice to the Controller of Coal Mines.

The Use of Gas Coke as Fuel.—In a pamphlet issued by the British Commercial Gas Association ("A Thousand and One Uses for Gas," Vol. VI, No. 53), Mr. E. W. L. Nicol, Assoc.I.E.E., fuel expert to the London Coke Committee, gives a number of examples of the utilisation of coke as boiler fuel, showing a considerable saving as compared with coal. In the case of an installation where the annual consumption of coal was 3,000 tons, an evaporation of about 10 lb. of water from and at 212° F. was obtained with coke under ordinary working conditions, and the weight of fuel used was reduced by 10 per cent., in addition to which the recovery of the valuable by-products from the coal should be set on the credit side of the national account. By the use of the forced-draught apparatus supplied by the London Coke Committee, which consumes only 3 per cent. of the steam generated, an ample range of draught is obtained for the efficient combustion of coke, and the carbon dioxide in the flue gases can be maintained at about 15 per cent. It is estimated that the quantity of raw coal displaced by coke in the Metropolitan area is now 250,000 tons per annum. The chain-grate stoker can easily be adapted to burn coke or coke breeze.

Extensions at Chesterfield Electricity Works.—On March 27th a new turbo-alternator of 2,000 KW. was officially inaugurated. The plant, which has cost with accessories about £20,000, is expected to save over 400 tons of coal a year. In the course of a speech Mr. R. L. Acland, borough electrical engineer, referred to the satisfactory results of linking-up with the Staveley Coal and Iron Co., but expressed the view that the scheme of superstations was Utopian; the cost of transmission appeared to have been overlooked.

Electric Vehicle Progress.—The March issue of *The Electric Vehicle* contains an account of the Midland Railway Company's fleet of 76 electric vehicles, recently described in our pages, and states that the company finds the total costs per annum to be "very distinctly in favour of electrics" as compared with petrol. Their special field is said to be that of replacing horses on delivery circuits of moderate distance, and the company considers it advisable to keep the speed of electric vehicles low, as the running time forms comparatively a small proportion of the total time that a vehicle is in use.

Thirty-two new electric vehicles purchased recently are listed, and in addition many other orders are awaiting permits from the Ministry of Munitions.

An illustrated article shows light electric passenger cars recently built to run 60 to 90 miles on a single charge in the United States, costing 8·95d. per mile, inclusive of repairs and stores, and of 3d. for the wages of two drivers.

In an account of the work of the Electric Vehicle Committee, Mr. F. Ayton, hon. secretary, states that successful efforts have been made to facilitate the manufacture of electric vehicles in this country and to remove some of the restrictions on the importation of vehicles and battery plates from the U.S.A.

Mr. Ayton's article on "Battery Charging" is continued, and other interesting items are contained in this issue.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur in the offices of president, vice-presidents, honorary treasurer, and ordinary members of Council, on September 30th, 1918 :—

President (one vacancy).—C. H. Wordingham, Director of Electrical Engineering, the Admiralty.

Vice-Presidents (two vacancies).—W. A. Chamen, engineer and manager, South Wales Electric Power Distribution Co., Cardiff ; R. A. Chattock, city electrical engineer, Corporation Electric Supply Department, Birmingham.

Honorary Treasurer (one vacancy).—J. E. Kingsbury, director, Anglo-Portuguese Telephone Co., Ltd., Western Electric Co., Ltd.

Ordinary Members of Council—Members (five vacancies).—F. Ayton, chief engineer and manager, Corporation Electricity Supply and Tramways, Ipswich ; H. W. Clothier, electrical engineer, Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne ; A. C. Cramb, borough electrical engineer, Corporation Electricity Works, Croydon ; A. R. Everest, electrical engineer, the British Thomson-Houston Co., Ltd., Rugby ; Sir R. A. Hadfield, Bart., F.R.S., electro-metallurgist ; Prof. E. W. Marchant, D.Sc., Professor of Electrical Engineering, the University, Liverpool ; C. C. Paterson, O.B.E., National Physical Laboratory, Teddington ; J. Sayers, telegraph superintendent and electrical engineer, Midland Railway, Derby ; Prof. E. Wilson, Professor of Electrical Engineering, King's College, London.

Associate (one vacancy).—D. N. Dunlop, director and secretary, British Electrical and Allied Manufacturers' Association (Incorporated).

The following are the nominations for office bearers in the Scottish Local Section for next session :—Past chairmen, Messrs. D. A. Starr, J. K. Stothert, and Arch. Page ; chairman, Mr. J. F. Neilson ; vice-chairmen, Messrs. Alex. Lindsay and W. B. Hird ; hon. secretary, Mr. Joseph Taylor ; assistant hon. secretary, Mr. W. F. Mitchell ; chairman (Students' Section), Mr. F. W. Whysall. Committee : Messrs. A. S. M'Whirter, D. M. MacLeod, J. E. Sagers, Sam Mavor, E. T. Goslin, A. S. Hampton, W. Wood, R. B. Mitchell, Frank Anslow, W. J. Belsey, and J. M. S. Maxwell.

Greenock Electrical Society.—The annual meeting of the Society was held last week, Mr. Samuel James (president) in the chair. It was resolved to invest the balance of funds, together with donations, in war certificates, and to alter the name of the Society to "Greenock Association of Electrical Engineers." The names of Mr. W. A. Toppin, Chesterfield, and Mr. W. Robert Scott, Paisley, were added to the list of honorary members. Office-bearers were elected for next session as follows :—Hon. president, Mr. J. W. Kempster ; president, Mr. George Macdonald ; vice-presidents, Messrs. S. James, H. J. Roberts, and W. B. Smith ; treasurer, Mr. H. Piggott ; and secretary, Mr. G. T. Morrison, 14, Brisbane Street, Greenock.

Irish Association of Electrical Station Engineers.—The annual meeting was held in Dublin. Mr. W. Nolan was re-elected chairman, Mr. W. P. Curly treasurer, and Mr. T. W. Dycher secretary. The Committee is as follows :—Messrs. B. C. Muntz, L. Walsh, H. E. Hunt, P. E. O'Shea, T. H. Lurring, P. Carroll, J. Harding, and W. O'Connell.

Association of Mining Electrical Engineers.—At a meeting of the East of Scotland Branch at Buckhaven, Fife, on Saturday, Mr. W. Dempster (Leven) read a paper on "Notes on Operating Mining Machines." He said Fife had turned out some of the smartest and best machine operators he had met, but since the war began there had been an appreciable falling-off in the quality of labour available, and in many cases that had resulted in the machines getting into discredit. There was a call for the better training of machinemen. He held that coal-cutter operators, like foremen or deputies, should be certificated.

Appointments Vacant.—Shift engineer (63s. 3d.) for the Bury Corporation electricity department ; meter reader (36s. + 14s.) for the Borough of Burnley electricity works ; cable jointer for Eccles Corporation electricity works ; charge engineer for the Dover Corporation electricity works ; shift engineer for the Stretford U.D.C. electricity department ; two charge engineers (50s. to 60s.) for the Royal Engineers' Camp, Ripon ; shift engineer (55s.) for the Sevenoaks and District Electricity Co., Ltd., works, Sevenoaks ; charge engineer for the Dover Corporation electricity works ; two switchboard and sub-station attendants (50s. to 65s.) for the Borough of Salford electricity department. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.— The Darwen Tramways Committee has accepted the resignation of Mr. F. J. S. Hoskens, the tramway manager, and is to appoint a successor at £250 a year.

The Preston Town Council has decided to increase the salary of Mr. J. F. Simpson, tramway engineer and manager, from £400, with £31 war bonus, to £500 per annum.

The Keighley T.C., on March 26th, decided—despite some opposition—to increase the salary of Mr. Harry Webber, as tramway manager, from £100 to £175 per annum, in addition to his salary of £400 as electrical engineer, and that, in accordance with the award of the Committee on Production, all the male employés over 18 be granted war wages equal to £1 over pre-war rates, and that the women be granted an additional bonus of 4s. a week, as from March 1st.

The salary of Mr. H. P. Stokes, electrical engineer and tramway manager of the Bexley Council, has been increased by £200 per annum as from January 7th, 1918. Mr. James Makin, of Stoke-on-Trent, has been appointed chief assistant of the Bexley electricity and tramways undertaking at £300 per annum.

Mr. Albert MacKrill, for 15 years chief clerk to the Hull borough electrical engineer, is leaving to become commercial manager at the Stoke-on-Trent Corporation electricity works.

The six candidates for the position of deputy general manager of the Liverpool Corporation tramways who were left in the final list were Mr. J. S. D. Moffett, Belfast, who was selected ; Major F. Coutts, Paisley Tramways Co. ; Mr. G. F. Craven, Reading Corporation ; Mr. A. R. Dayson, Sunderland Corporation ; Mr. P. Priestley, Oldham Corporation ; and Mr. W. T. Robson, Southampton Tramways.

On the occasion of his marriage, Mr. Thos. Wallwork, who is at the Blackburn Corporation Electricity Works, was the recipient of a presentation from the staff.

The Haslingden Electricity and Tramways Committee has increased the salary of Mr. Kay, tramway manager, to £225 per annum.

Mr. J. D. Caird, traffic manager of the Halifax Corporation tramways, has been granted leave of absence, his medical adviser having certified that it is necessary for him to have a change of air for four months.

The Maidstone T.C. has, on the recommendation of the Finance Committee, increased the salary of the tramway manager, Mr. Lambert, from £300 to £400 a year.

A bonus of £20 per annum is to be paid to the following officials on the technical staff of the Blackpool Corporation Electricity Department, who received increases of salary in October last :—Electricity works superintendent, mains superintendent, chief clerk, and two shift engineers-in-charge. The bonus is in lieu of the 12½ per cent. granted under the Askwith award, and is payable from the date of the award.

General.—Wm. P. Brown, electrical wireman, of Dunfermline, who rescued a man from downing at a certain part of the Scottish coast, has been awarded an honorary certificate and £5 by the Carnegie Heroes' Fund Trustees.

Roll of Honour.—Lieut. (Acting Captain and Adjutant) V. C. Russell, Suffolk Regiment, younger son of Mr. Stuart A. Russell, works manager of the India-Rubber Co., Silvertown, has been awarded a bar to the Military Cross. He was awarded the Military Cross in November last, and previous to that had been twice mentioned in dispatches. Lieut. Russell has been wounded twice.

Private H. Hasler, East Surrey Regiment, formerly in the general office of this company, has been missing since October 26th, 1917.

Sergeant-Major G. Thudon, Surrey Regiment, for some years on the Croydon Corporation tramway staff, has been awarded the D.C.M. for bravery in carrying 11 wounded men out of action under heavy fire.

Wireless Operator H. O. Smith, of St. Helens, has been lost at sea through his vessel being sunk by a submarine.

Private D. E. Cooper, London Scottish, who has died of wounds, was an electrician at the works of Messrs. Jones and Attwood, at Stourbridge.

Private Leonard Brownbridge, R.N.D., who has been gassed, was on the electrical staff of the Blackpool Corporation tramways.

Private Martin Monaghan, R.E., of Gorton, killed on March 21st, was an electrician.

Corporal E. Lindley, R.G.A., killed in action, was employed by the Chloride Electrical Storage Co., Ltd., Clifton Junction.

Private Robert Aspinall, L.N.L. Regiment, employed by Messrs. Dick, Kerr & Co., previously reported missing, is now reported killed.

At Bolton Town Hall, the Mayor decorated Gunner E. Hopkins, R.F.A., a former employé of the Bolton Tramways Department, with the Military Medal awarded in September, 1916, at the taking of St. Julian, in the third battle of Ypres, for extinguishing a fire at an ammunition dump which had been caused by an enemy shell.

Second Lieut. T. E. Talbot, R.F.A., late of Messrs. Mather and Platt, has died of wounds received in action.

It was stated at a meeting of the officers and staff of Amalgamated Wireless (Australasia) Ltd., at Sydney, in January, that Capt. Payne's death, while serving with the Australian Forces, was recently announced from Bagdad. He left Australia early last year in command of a large signal squadron. In civil life he was associated with the Marconi Co., Australasian Branch, and, later, Amalgamated Wireless (Australasia), Ltd., and, after joining the A.I.F., was kept for two years in Australia, owing to the importance of the work he was performing in connection with wireless telegraphy. He organised the entire scheme for military wireless training in the Commonwealth, and, at the same time, retained his association with the Amalgamated Co., acting as manager in the absence from Australia of the general manager of that company during 1915-16.

Obituary.—Mr. R. W. Blackwell.—We regret to record the death, which occurred at Hampstead, on March 28th, at the age of 60 years, of Mr. R. W. Blackwell, M.I.E.E., chairman of Robert W. Blackwell & Co., Ltd., and Johnson & Phillips, Ltd. We hope to refer to his career in our next issue.

The death has occurred, at the age of 73 years, of Mr. G. H. Williamson, of Worcester, who was for seven years chairman of the Electricity Committee.

Mr. E. Stansfield, who was the principal promoter of the St. Anne's electricity works, has passed away at the age of 79 years.

Mr. F. W. Streatfield, late superintendent of Chemical Laboratories, Finsbury Technical College, passed away on March 24th, aged 60 years.

NEW COMPANIES REGISTERED.

Omegar Lampworks, Ltd. (149,947). Private company. Registered March 22nd. Capital £2,000 in £1 shares. Manufacturers of and dealers in electric lamps, motor and aircraft accessories, &c. The subscribers (each with one share) are: J. A. Scoular, 83, Merton Road, S.W. 19, Mary Scoular, 83, Merton Road, S.W. 19, Margery Scoular, 83, Merton Road, S.W. 19. The first directors are: J. A. Scoular and Mary Scoular. Qualification, £50.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Allen, West & Co., Ltd.—Particulars of £25,000 debentures created March 11th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Egham and Staines Electricity Co., Ltd.—Agreement dated December 12th, 1917, extending time for payment of, and increasing rate of interest on £12,000 debentures outstanding of a series authorised September 28th, 1912. (Notice filed March 18th, 1918.)

A. Vernon Ward (Hove), Ltd.—Debenture dated March 20th, 1918, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Rosenberg, 259, High Holborn, W.C.

Aluminium Corporation, Ltd.—Mortgage dated March 7th, 1918, to secure £1,000, charged on lands in Carnarvonshire. Holder: J. H. Pell, Northampton.

Wright & Wood, Ltd.—Memorandum of satisfaction in full on March 14th, 1918, of mortgage dated November 18th, 1917, securing £554 8s., has been filed.

Coniston & District Electric Supply Co., Ltd. (138,478). Capital, £2,000 in £1 shares (1,500 6 per cent. pref. and 500 ord.). Return dated December 31st, 1917. 375 pref. and 600 ord. taken up; £695 paid; £280 credited as paid. Mortgages and charges: Nil.

Central Electric Supply Co., Ltd. (53,080).—Capital, £100,000 in £5 shares. Return dated February 26th, 1918. All shares taken up, £100,000 paid. Mortgages and charges: £500,000.

CITY NOTES.

Brompton and Kensington Electricity Supply Co., Ltd.

At the annual meeting, the Chairman said that in 1917, in spite of a longer period of "summer time," they sold 12 per cent. more units than in 1916, and with the increase in price called for by the higher cost of coal and wages, the gross receipts increased from £55,878 to £61,898. As evidence of the justification of their policy of encouraging an accessory load (a load for other than lighting purposes), he mentioned that, although they now had nearly 20 per cent. more consumers than five years ago, they were supplying upwards of 20 per cent. less electricity for lighting, and although their area was essentially residential, only 5 per cent. of their new custom last year was for lighting, and they now sold not far short of the same quantity of current for accessory purposes as for lighting. The business of the Accessories Co., to which this condition of things was largely due, continued to develop satisfactorily, and further experience of its working confirmed the expectation that it would become a direct, as well as an indirect, source of profit in the future. The higher cost of coal and the increased wages involved in producing the larger output had happily been more than compensated for by the economies resulting from the more efficient plant they had installed, and by a large and exceptional readjustment of taxation which accrued to them during last year, so that their expenditure was actually less than in the previous year. It was this fortunate conjuncture of circumstances which had enabled them to resume the payment of the dividend, which they had paid for so many years, while making liberal provision for contingencies. The prospects of the current year were very far from being satisfactory. Their prospects of revenue were clouded by the still longer period of "summer time," and by "curfew" restrictions of a most drastic nature. Their prospects of expenditure were even more ominous. The deliveries of coal under the contracts they had made for the replenishment of their stocks had been diverted by the Government in favour of less provident undertakers in the Metropolis who had found themselves short of supplies, and, although they would endeavour to obtain redress for the consequential damage sustained, they must look forward to largely increased expenditure on this important item. As to wages, although their relations with their employés had always been of the pleasantest nature, their wages bill had been increased by Government decisions on the top of their voluntary grants, beyond all anticipation, and whilst refraining from any comment which in the present emergency might add to the difficulties of the situation, he would say that their pre-war scale of wages would be more than doubled in the immediate future. The maintenance of their profits in face of such increased cost of working by raising their price was only a choice of evils.

British Insulated and Helsby Cables, Ltd.

Dr. E. K. Muspratt, presiding at the annual meeting at Liverpool, said that the results for 1917 were the best they had ever obtained. They hoped that the help that they had rendered in connection with the war would not be overlooked or forgotten in the future. While control might be necessary under prevailing conditions, the Great British manufacturing concerns must in the interests of national prosperity resume full control of their own affairs at the earliest moment consistent with public safety. He had a growing feeling that factories established with public money for national purposes during the war might prove their chief competitors for Government business after the war. When the war was over strenuous efforts would be necessary to resume the important position that they held before it began. The company was in as good a position to compete for export business then as any manufacturer in the same line in this or any other country. Referring to the capitalisation of reserves and the proposal to issue bonus shares, they had reached a point when further increase in reserves would not be justified. The dividends paid during recent years had shown a percentage on the ordinary shares which was misleading to the public, because the reserves were employed as capital in the business, and in 1917 the actual capital employed represented more than double the amount of the nominal share capital. The Treasury had consented to their increasing the share capital by the capitalisation of £500,000 of the company's surplus assets out of the reserve account, and to issue to the ordinary shareholders a further 500,000 shares of £1 each.

City of London Electric Lighting Co., Ltd.

Mr. J. B. Braithwaite, presiding at the annual meeting recently, said that though their relations with the staff during the year had been most harmonious, the action of the Government with regard to labour had given them considerable anxiety and increased their difficulties. They had an increase of 714,000 in units sold. The revenue, partly owing to increased sales and partly owing to war percentages charged to consumers, showed an increase of £18,250, and expenses £10,414, of which £8,000 was for coal. The net increase in revenue was £7,861, enabling them to revert to their appropriation of £50,000 to the reserve fund. Due to the efforts of Mr. Frank Bailey, they established, at a cost of £350, a welfare canteen to assist employés in the difficult times before rationing became universal. In regard to the need for economising coal and the Coal Controller's measures for rationing electricity, electricity supply companies were really saving coal. As he pointed out a year ago, the electricity supply industry had saved millions and millions of tons of coal to the country. Mr. Bailey had put together a few figures which showed that 18 years ago they used 78,000 tons of coal to produce 14,700,000 units; they now required only 41,000 tons of coal to produce about 36,000,000 units. In other words, whereas they formerly obtained only 188 units per ton, they now got 878 units, or about 4½ times more. As regarded lighting, when they started as pioneers, 1 unit of electricity gave 250 c.p. for one hour; now they got 2,000 c.p. out of the same expenditure of electric current; in fact, Mr. Bailey said "a little money buys a lot of current, and a little current makes a lot of light." Last year, for heating they supplied nearly 4½ million units, this being used in about 8,500 electric radiators, which replaced coal fires, which in the ordinary way would have required 12,000 tons of coal. A calculation showed that instead of this 12,000 tons, they had given a better result by using 4,500 tons of coal, or a saving of 7,500 tons of coal in that item of heating alone. That was in addition to the wood required for kindling, the matches required for lighting, and all other matters of that kind. For power purposes, they sold 11,416,000 units last year. Some of their most important consumers had given them the results of their experience since they abandoned the use of their own steam plant and took the whole of their requirements from the company's mains, and they found that, applying this information to the whole of their power supply, they were saving about 45,000 tons of coal annually to the nation. The users of this supply were not only participating in this saving, but they also secured the benefit of utilising space which would otherwise be required for their own plant, with many other advantages. In the past year alone they had, therefore, saved 45,000 tons of coal on their power supply and 7,500 tons of coal on their heating supply, or a total of 52,500 tons. Therefore, as he said last year, he said again that the Coal Controller, in seeking to cut down the coal consumption of the electric supply undertakings, was tending to increase the consumption of coal rather than to diminish it, because every ton they burnt, whether the current it produced was used for lighting, heating, or power, was doing work which otherwise would only be done by a very much greater expenditure of coal, so if he really wanted to save coal he ought to urge everyone to use electricity, to replace their steam engines by electric motors, their open fires by radiators, and their gas by electric lamps; and by doing that he would really promote an economy in coal. As it was, he was afraid his attempt to secure economy of coal by cutting down the electric supply would only have one result, and that would be to injure the trade of the country, because, if people were to have power to carry on the business of the country, the cheapest power they could have was electric power, and if he insisted on cutting that down obviously one of two things must happen—either they must go back to steam plant and burn a much larger amount of coal, or else they would have to shut down altogether, to the detriment of the industries of the country as a whole.

German Companies.

The Ver. Isolatoren Werke A.G., of Berlin-Pankow, reports net profits amounting to £12,000 for 1917, as contrasted with £15,000 in the previous year. It is intended to pay a dividend of 20 per cent., being the same rate as in 1916.

The directors of the *Lloyd Dynamo Works Co., of Bremen*, recommend a dividend of 7 per cent. for 1917, this comparing with no distribution in the preceding year. It is proposed to increase the share capital by £50,000 to £100,000.

The accounts of the *Deutsche Kabelwerke, of Berlin*, show gross profits of £101,000 for 1917, as compared with £65,000 in the previous year. The net profits are returned at £45,000, as against £31,000, and a dividend of 10 per cent. is proposed, as contrasted with 8 per cent. in 1916.

The report of the *Sachsen Werk, of Niedersedlitz*, states that the turnover in 1917 exceeded a value of £1,000,000, and the net profits are £219,000. It is proposed to pay a dividend of 30 per cent. on share capital of £375,000, as against 20 per cent. in 1916. The directors state that they are improving the plant and equipment, and the type made, so as to be prepared for the expected demand on the conclusion of peace.

The report of the *Norddeutsche Kakelwerke A.G., of Neu-Kolln*, states that it was impossible for sale prices in 1916-17 always to keep pace with the constantly increasing cost of raw materials and labour, and if the working results were satisfactory this fact was due to the doubling of the value of the turnover. The accounts exhibit net profits, after allocating £11,000 to depreciation, as compared with £4,000 in 1915-16, amounting to £18,000, as against £11,000. A dividend at the rate of 12 per cent. has been declared, this contrasting with 10 per cent. in the preceding year.

The Fabrik Isolierter Drahte (vorm. C. J. Vogel), of Berlin, reports that, despite the difficulties in establishing large installations during the war, it had yet been possible to complete the cable factory building and proceed with the internal equipments, so that production would begin shortly. All the departments were well occupied in 1916-17, and further progress was made. After apportioning £3,800 to depreciation, as in the previous year, the accounts show net profits of £63,000, as against £57,000, and a dividend at the rate of 18 per cent. has been declared on share capital of £175,000, as compared with 16 per cent. in 1915-16, and 8 per cent. on new capital of £87,000.

Chelsea Electricity Supply Co., Ltd.—The profit for 1917 was £35,563, plus £3,684 brought forward, and £1,631 for interest. After putting £15,670 to reserve for renewals, depreciation, and contingencies, writing £1,089 off cost of extinction of founders' shares, and £1,000 off investments, 6 per cent. is paid on the preference shares, and 5 per cent. for the year on the ordinary, leaving £3,479 to carry forward. 9,605 lamp equiv. (8-c.p.) were added during the year, making 337,133, and the total units sold were 4,738,672, or 467,202 more than for 1916.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Presiding at the annual meeting, Dr. J. B. Simpson said that arrangements had been made for carrying out certain experimental work jointly with the Newcastle Electric Supply Co., and £5,000 had been set aside for that purpose. The new plant at the Weardale power station was now undergoing trials. It was hoped to make a commencement in the near future with the constructional work in connection with the proposed power station at Horden.

Bromley (Kent) Electric Light & Power Co., Ltd.—During 1917 the connections increased from 4,499 to 4,771 kw. There was a profit of £9,645, compared with £8,573, and after payment of debenture interest and trustees' fees, &c., amounting to £3,335, and adding £1,538 brought forward, 5 per cent. dividend for the year is paid, and £2,500 is placed to general reserve, leaving £1,599 to be carried forward.

Salisbury Electric Light & Supply Co., Ltd.—Mr. C. J. Woodrow, addressing the annual meeting, said that in order to meet the increased costs they had raised the charges for electricity by 20 per cent., but other companies had raised theirs by a third, and some by a great deal more.

Cleveland & Durham Electric Power, Ltd.—Gross profits £38,780, against £37,130. After paying debenture interest and putting £10,000 to depreciation, 2 per cent. is paid on the preference shares, £1,000 is put to reduction of expenses of debenture issue, and £9,726 is carried forward. Connections increased by 2,268 h.p. to 83,737 h.p.

At the annual meeting on March 28th, Mr. J. H. Armstrong said that while the gross profits were £1,649 more, the gross expenditure had also very greatly increased. It had been expected that the new turbo-generator would have been in commission some time ago, but it had only been installed three weeks, and consequently they had not benefited during 1917. Another factor that had affected the revenue was the considerable shortage of waste heat, which was down by no less than 1,603,634 units. This necessitated their coal-fired station doing more work, and costs had been correspondingly increased. Cost of coal had risen by £8,000, and wages, as a result of the Government awards, had been advanced by £8,110, while repairs and maintenance had increased by £5,307. In consequence of having been confined to the coal-fired stations for their supplies, they had had to make very much larger requests upon the Newcastle Supply Co. for current. As to the future, applications for current amounted to more than 31,500 h.p., and in order to meet that, arrangements had been made to install a second turbo-generator of 6,000 kw. That would not be in commission for three months, but it was hoped that the two generators would meet the requirements of the company until the new Tees power station was running.

Scarborough Electric Supply Co., Ltd.—At the annual meeting, Mr. G. Alderson Smith said that coals had cost £346 more, and wages and other items were also higher, while there was increasing difficulty in getting material. They had had to refuse a largish job because they could not get the material for it. Mr. Campbell Swinton, managing director, said that they were suffering from a great loss of income due to the conditions imposed upon them by the authorities in 1914. The gross revenue was £12,560. It fell in 1915 to £8,631, and in 1916 was £8,682. They could only be thankful that last year it had gone up again to £10,205. Still, that was £2,500 less than in the year the war broke out. Until circumstances changed, he did not think they could hope to do very much better than at present. He thought it was very satisfactory on the whole that they had made a profit this year of over £2,000. In 1914 the profit was £4,212, in 1915 it had fallen to £1,078, and in 1916 to £714. All they could do was to hope for better times when the war came to an end.

Mersey Power Co.—Speaking at the meeting of the Salt Union, Ltd., last week, the Chairman said, with regard to the Mersey Power Co. :—

> The insistent demand for electrical energy on the part of present and prospective consumers, coupled with the recommendation of the Government Committee that super-power stations shall be established in suitable positions throughout the country, has compelled the board of the Mersey Power Co., with the assistance of the Salt Union to take steps whereby its outturn shall be very greatly increased. I told you last year that contracts had been entered into for additional machinery, none of which, I regret to say, has yet been completely installed, but we hope to have it working a few months hence. The Mersey Power Co. has an issued capital of £100,000 in £1 shares. The Salt Union has agreed to subscribe for another 1,000,000 shares, while the Government has consented to grant a loan of £300,000 on reasonable terms and conditions. The next steps to be taken are the choice of the site and the obtaining of plans and specifications for the machinery, &c., and these matters are in process of negotiation.

Stewarts & Lloyds, Ltd.—Dividend, 2s. per share on the deferred shares, free of tax, and a bonus of 6d. per share, carrying forward £105,892, against £111,122 brought in. £100,000 to depreciation, and £20,000 to employés' benefit fund.

Crompton & Co., Ltd.—The directors are stated to be making an issue of £150,000 6 per cent. first mortgage debentures at 95 per cent. to take the place of the existing £100,000 5½ per cent. debentures.

Clarke, Chapman & Co., Ltd.—The Court have made an Order directing that meetings of preference and ordinary shareholders be held to approve of the proposed scheme of arrangement between themselves and the company.

Mirrlees Watson Co.—Dividend 10 per cent., and bonus 2½ per cent., both less tax; £20,000 to general reserve; £7,264 carried forward.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during the five weeks ended February 1st, 1918, 2,456,464, as compared with 2,186,267 units last year.

Para Electric Railways & Lighting Co., Ltd.—Further dividend of 4 per cent. on ordinary shares, making 7 per cent. for year.

Bombay Electric Supply & Tramways Co., Ltd.—Dividend of 10 per cent. and a bonus of 4 per cent. on the ordinary shares, for 1917.

Lima Light, Power & Tramways Co.—Dividend, 1½ per cent.

Midland Electric Corporation for Power Distribution, Ltd.—Dr. E. K. Muspratt, presiding at the annual meeting, referred to the continued satisfactory increase of the business. The year's capital expenditure had been £52,182. Further applications for 10,000 H.P. had been received which, if accepted, would mean again extending the generating plant. The matter was under consideration, as was also the means of obtaining the necessary capital (£100,000). Generating and distributing costs were very much higher, but the profit balance was £11,464 better. The increases in rates to consumers were considerably below the total increased cost to the company. After paying 6 per cent. dividend on both classes of shares (an increase of 1 per cent. on the ordinary), £17,153 was to be carried forward.

Italy.—The Società Ligure-Toscana di Elettricità, of Leghorn, has decided to increase its capital from 30,000,000 lire to 50,000,000 lire.

The Società Officine Meccaniche (formerly Miani Silvestri and Co., and A. Grondona, Comi & Co.), of Milan, have decided to issue a further 6,000,000 lire of shares, thus raising its capital to 24,000,000 lire.

The Società Emiliana di Esercizi Elettrici, of Parma, has decided to increase its capital from 1,750,000 lire to 3,150,000 lire.

Compania de Electricidad de la Provincia de Buenos Aires.—For the year ended July, 1917, the KW.-hours sold were 6,283,972, against 6,295,842; customers 14,451, against 13,583; and gross revenue £206,072, against £189,885. Increase in gross was 8.52 per cent., and the total receipts of £209,988 increased 9.23 per cent. Total expenses in the Argentine were £152,796, this increase of 20.32 per cent. being entirely attributed to the abnormally high prices of fuel and of all materials. The net profit from operation was £54,902, against £62,728. The directors regret that the results do not permit the payment of a preference dividend. The loss for the year amounted to £2,110, less £630 discount on debentures, leaving a credit of £1,258.—*Financial Times*.

Tyneside Electrical Development Co., Ltd.—Profit for the year £4,290, plus £933 brought forward. Dividends, 6 per cent. on the preferred ordinary, and 10 per cent. on the deferred. General reserve £1,000. Carried forward £761. The 5 per cent. pref. shares in the Cleveland and Durham Co. had been exchanged for 5 per cent. pref. in the Newcastle-upon-Tyne Co. The company's investments yielded a satisfactory return.

STOCKS AND SHARES.

Tuesday Evening.

There was a little flicker of business round the Stock Exchange markets upon the resumption after Easter, but no real activity developed, nor is it likely to do so while the present phase of the war continues. For once in a way, holidays—even at Easter,—seemed almost inappropriate. The prospect of an advance in the age limit is regarded with seriousness in the Stock Exchange from the business point of view, because of the effect it would have upon the community at large; the proposals of the Government on this head are awaited with an interest at least equal to that surrounding Budget anticipations. Meanwhile, prices keep steady in most directions, and the only markets to show actual weakness are those in which there has recently been buying of the speculative order.

The case of Courtaulds, the textile company whose shares have lately had so remarkable a rise, is quoted as a possible warning to other concerns that have declared bonuses in the shape of /share issues. Courtaulds announced their intention of reorganising the capital in a way that involved distribution of new shares and increase of capital. The shares shot up in price, but came down again abruptly on the Treasury's temporary refusal to sanction the scheme. Therefore, Callenders, Henleys, and other shares have reacted, lest the Treasury should apply the same probibition to the melon-cutting suggestions put forward in their cases. The ways of the Committee of New Issues are so dark and freakish, however, that the sauce for the goose does not necessarily apply to the gander, and the greater part of the rises scored by telegraph manufacturing shares is well maintained.

The Brompton & Kensington Co.'s report is one of the best of those presented last month by the electricity supply companies. As already noted here, the dividend is restored to the 10 per cent. from which it has deviated only once in 15 years, namely, in 1916. The astonishing part of the accounts is that working expenses actually decreased by about £300, although gross receipts are £6,000 up, and the net revenue of £50,500 is £6,100 better than in 1916. The board deserve hearty congratulation upon the excellent achievement.

Most of the shares in the electricity supply list are now ex dividend, which has the effect of making the yields look better, and of putting them upon an average basis of, roughly, 6¼ per cent. The manufacturing shares are rather duller in places. Westinghouse Preference fell ⅛, and Electric Constructions 1/16. India Rubber shares have reacted 10s. and Callenders are 15s. down. These declines, however, are small compared with the rises which took place just previously.

The same heavy tendency is noticeable amongst chemical and engineering shares. Castners went back to 8 9/16, while in the engineering class, Babcocks fell 3s. 9d. to 3¾. The appetite for these commercial shares is nothing like so keen as it was, but the explanation advanced for this in the market is simply that the public are waiting the issue of events on the Western Front, and that the only noticeable business takes the shape of a few sales in a market not particularly ready to absorb stock at the present time.

Underground Electric Incomes are a point lower at 78, and Metropolitan Consolidated eased off to 20½. Underground Electric £10 shares have given way to 30s., but the railway market generally, after being somewhat limp, now begins to show a slightly better tendency.

Marconis came down sharply to 3¼ upon a slight pressure to sell by speculative buyers; other shares in the group are similarly affected. Americans, for instance, are 1s. 6d. lower at 25s. 6d., though Marines keep firm at 2½. In the cable group, there is not much change. Chile Telephones are better at 7⅝.

The rubber market has paused with the rest, and, while prices are fairly well maintained, there is not much trade doing. The only noticeable Stock Exchange activity immediately after the holidays was a spring upwards in shares of several Cornish tin mines. The activity, however, was limited to these, and it passed by the shares of the West African and Malayan markets. There is a rather better tendency amongst armament descriptions.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price April 2, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅞	—	£7 8 0
Charing Cross Ordinary ..	5	4	9¼xd	—	5 14 4
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	8	8	3	—	5 4 4
City of London	8	8	12⅞xd	—	6 9 3
do. do. 6 per cent. Pref.	6	6	9⅛xd	—	6 0 4
County of London	7	7	10⅝xd	—	6 11 0
do. 6 per cent. Pref.	6	6	9⅞xd	—	6 0 4
Kensington Ordinary	6	7	5⅝	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	8	4	3⅝	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	9	7⅛	—	6 6 4
South London	5	5	2 1/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅝	—	7 0 6

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	88/6	1½	22⅝	—	6 18 4
Chile Telephone	8	8	7⅝	+ ⅛	5 8 4
Cuba Sub. Ord.	5	7	9¼	—	*7 11 4
Eastern Extension	8	8	15⅝	—	*5 4 0
Eastern Tel. Ord.	8	8	153½	—	*5 4 6
Globe Tel. and T. Ord.	7	7	14½xd	—	*4 18 3
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	18	18	51½	—	6 6 8
Marconi	10	15	8¾	— 1/8	4 8 0
Oriental Telephone Ord. ..	10	10	4 3/16	— 1/16	2 7 1
United R. Plate Tel.	8	8	6⅝	—	*5 17 4
West India and Pan.	6d.	6d.	1⅝	—	*3 17 0
Western Telegraph	7	8	15¾xd	—	*5 5 0

Home Rails.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Central London, Ord. Assented	4	4	61½	—	6 10 7
Metropolitan	1	1	20½	— ½	4 17 7
do. District	Nil	Nil	14⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	— ⅛	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	78	— 1	*5 2 6

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2¾	— ⅛	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	— ½	7 11 0
Brazil Tractions	4	4	42	- 2½	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	52½	—	9 12 4
do. do. Preferred	Nil	Nil	32½	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	58xd	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	8½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	36½	—	—

Manufacturing Companies.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Babcock & Wilcox	15	15	3¾	— 1/16	4 12 4
British Aluminium Ord. ..	7	10	32/-xd	—	6 5 0
British Insulated Ord.	17½	20	8⅝xd	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2 1/16	— ⅛	5 6 7
Callenders	20	20	17½	— ¾	5 15 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 1/16	— 1/16	5 12 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1 1/16	— 1/16	6 6 4
Gen. Elec. Pref.	6	6	10⅝	—	5 15 5
do. Ord.	10	10	20	—	5 0 0
Henley	25	25	19½	—	6 8 2
do. 4½ Pref.	4½	4½	3¾	—	6 12 2
India-Rubber	10	10	15⅞	— ½	*6 6 0
Telegraph Con.	20	20	42xd	—	*5 18 0

* Dividends paid free of income-tax.

THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

From the Annual General Report of H.M. Chief Inspector of Mines, for the year 1916, we are pleased to note that the use of electricity in mines has made a considerable advance, notwithstanding the difficulties in obtaining plant and machinery due to the war. Naturally, the increase is not so great as in the year 1915, as in that year much of the work installed during 1915 would undoubtedly be machinery ordered previous to, or shortly after, the outbreak of war.

The following table shows the aggregate amount of electrical H.P. in use at the end of the year 1916, in the different Inspection Divisions:—

TABLE I.

Division.	Southern.	Underground.	Total.
	H.P.	H.P.	H.P.
Scotland	35,697$\frac{21}{40}$	124,251$\frac{2}{5}$	159,948$\frac{37}{40}$
Northern...	97,148$\frac{7}{10}$	103,996$\frac{13}{20}$	201,145$\frac{7}{20}$
York. and North Midland	86,718$\frac{3}{4}$	67,267$\frac{1}{8}$	153,985$\frac{7}{8}$
Lancashire, North Wales and Ireland	17,430$\frac{1}{2}$	27,222	44,652$\frac{1}{2}$
South Wales	116,169$\frac{2}{5}$	114,740$\frac{3}{4}$	230,910$\frac{3}{20}$
Midland and Southern ...	15,281	44,737$\frac{3}{4}$	60,018$\frac{3}{4}$
Total	368,445$\frac{7}{8}$	482,215$\frac{27}{40}$	850,661$\frac{11}{20}$

While the table below shows the increase:—

TABLE II.

—	Surface.		Underground.		Total.	
	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.
1915	336,102$\frac{4}{5}$	14·28	468,628$\frac{11}{40}$	11·66	804,731$\frac{3}{40}$	12·74
1916	368,445$\frac{7}{8}$	9·63	482,215$\frac{27}{40}$	2·90	850,661$\frac{11}{20}$	5·71

The number of electrically-driven coal cutters in use at the end of 1916 was 1,590, being an increase of 141 machines over those in use at the end of the preceding year. The three following tables give details of both electrical and compressed-air coal-cutting machinery, which are both interesting and instructive.

The number of machines, and of collieries where used, motive power employed, and quantity of mineral obtained by their use in the various Inspection Divisions during the year 1916 are shown in Table III.

The number of mechanical coal cutters in use in the various Inspection Divisions during the year 1916 was as shown in Table IV.

The quantity of mineral cut by machinery in the various Inspection Divisions during the year 1916, is shown in Table V.

We regret to note, however, that there were ten fatal accidents due to the use of electricity—viz., four below ground and six on the surface. So far as the former are concerned, this is a decrease of four on the previous year. The number of fatal accidents below ground, however, shows a distinct tendency towards improvement, especially when the increase in the use of electrical horse-power is taken into consideration, as the following figures show:—In 1907 there were ten fatal accidents below ground; in 1908, 12; 1909, 13; 1910, 15; 1911, 9; 1912, 7; 1913, 13; 1914, 4; 1915, 8; and 1916, 4.

TABLE III.

Division.	Number of collieries where machines are at work.	Number of machines.	Worked by Electricity.	Worked by Compressed air.	Mineral obtained.	Number of conveyors at coal face.
					Tons.	
Scotland ...	232	987	841	146	9,764,280	102
Northern ...	82	671	139	532	3,778,653	70
York. and North Midland	127	802	387	415	7,739,275	12[illegible]
Lancashire, N. Wales, and Ireland	99	569	48	521	2,564,620	[illegible]
South Wales ...	60	136	51	85	650,260	137
Midland and Southern	67	294	124	170	2,308,310	18
Total in 1916 ...	667	3,459	1,590	1,869	26,805,398	491
Total in preceding year	638	3,089	1,449	1,640	24,510,124	424

TABLE IV.

Kind of machine.	Scotland.	Northern.	York. and North Midland.	Lancashire and North Wales and Ireland.	South Wales.	Midland and Southern.	Total.
	Number in use.						
Driven by electricity:—							
Disk	564	44	166	11	1	32	818
Bar	248	24	84	21	27	23	427
Chain	23	67	132	16	23	67	328
Percussive	3	—	1	—		2	6
Rotary heading ...	3	4	4	–	—	–	11
Total	841	139	387	48	51	124	1,590
Driven by compressed air:—							
Disk	100	41	157	123	2	14	437
Bar	4	16	49	48	18	7	142
Chain	1	18	76	24	28	45	192
Percussive	41	457	129	326	37	99	1,089
Rotary heading ...	—	—	4	—	—	5	9
Total	146	532	415	521	85	170	1,869
Total in 1916	987	671	802	569	136	294	3,459
Total in preceding year	908	605	753	447	139	237	3,089

As we have previously pointed out, these accidents are mainly due to inefficient maintenance or carelessness in in-

TABLE V.

Division.	Statute tons cut by— Electricity. Coal.	Fire-clay.	Iron-stone.	Oil shale.	Total.	Compressed air. Coal.	Fire-clay.	Ganister.	Iron-stone.	Total.	Total quantity of mineral cut by machinery.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Scotland	8,538,616	3,873	62,731	8,096	8,613,316	1,132,205		—	18,759	1,150,964	9,764,280
Northern	1,309,003	—	—	—	1,309,003	2,469,650	—	–	—	2,469,650	3,778,653
York. and North Midland ...	3,951,157	—	—	—	3,951,157	3,749,429	25,142	13,547	—	3,788,118	7,739,275
Lancashire, North Wales, and Ireland	353,437	–	—	—	353,437	2,211,183			—	2,211,183	2,564,620
South Wales...	286,744	—	—	–	286,744	363,516	—	—	—	363,516	650,260
Midland and Southern ...	1,068,354	51	340,541	—	1,408,946	869,846	—	–	29,518	899,364	2,308,310
Total in 1916... ...	15,507,311	3,924	403,272	8,096	15,922,603	10,795,799	25,142	13,547	48,307	10,882,795	26,805,398
Total in preceding year ...	14,040,982	909	332,453	3,928	14,378,272	10,046,702	2,8176	145	56,829	10,131,852	24,510,124

stallation, and one cannot be too insistent in urging colliery proprietors so to maintain their electrical plant and machinery that a workman unwittingly coming in contact with electrically-charged apparatus shall, so far as is humanly possible, be protected from receiving an electric shock. We would suggest that every colliery manager put the circumstances of the accidents as given below into the hands of his electrician with instructions to see if there is anything about the plant under his charge which might, under similar circumstances, result in a similar fatality.

At Oakwood Colliery, in Glamorgan, deceased, while signalling underground on the East Dip engine plane to the surface haulage engine room, was struck down and killed by alternating current of 500 volts pressure, which passed along the bare signalling wires from the surface. The wires were charged in consequence of a blizzard swaying power cables against them. The insulation was abraded to the extent of 2 in., probably by continued friction due to the gale.

At Binley Colliery, in Warwick, deceased was working a Mavor & Coulson coal-cutting machine. As he was standing with one hand on the controller handle and the other on the frame of the machine he received a shock. He was liberated almost immediately, but he died within a few minutes. Examination revealed the fact that the earth wire in the trailing cable was broken. The broken ends were, however, in such close proximity that it was possible to obtain intermittent positive results. There was evidence inside the casing that arcing had occurred, probably due to careless manipulation of the controller handle. Current was three-phase at 500 volts.

At New Haden Colliery, Cheadle, North Staffordshire, deceased, while tramming a tub, found that an unarmoured rubber-insulated cable had been knocked down by a fall. He took hold of it to lift it up and received a shock, from which he died in a few minutes. It was found that a piece of the insulation had been torn away by the fall, baring one core. The current was three-phase at 520 volts.

At East Pool and Agar Colliery, Illogan, Cornwall, the galvanised iron wire stay of a pole carrying bare conductors of a three-phase system at 440 volts broke at its anchor. It fell across one of the live conductors. The deceased, apparently unaware that the broken stay was electrically charged, took hold of it and was killed.

At Burnmoor Colliery, Durham, a cleaner-out at a coal-cutter was killed by an electric shock which he received by contact with the framework of the machine, which was rendered live through defects in connection with the cable plug box at the machine and the earth wire in the trailing cable.

At Blairenbathie Colliery, Kinross, a lineman began work on a high-tension transmission line before his assistant, whom he had sent to cut the current off, had returned to him and reported that the line was dead, and received a fatal shock. Three-phase system, 3,000 volts.

At Kingswood Colliery, Bristol, electrical power for this colliery is obtained from the Bristol Corporation, and the plant at the colliery sub-station consists of a three-panel switchboard (belonging to and under the supervision of the Corporation), a set of transformers, and a switch panel controlling the colliery supply. Three-phase current is delivered to the colliery company at a pressure of 6,600 volts, and is then transformed to 3,200 volts. Deceased was a foreman in the employ of the Corporation, and was killed while working at one of the panels. Current had been cut off the panel at which work was being done, but deceased, for some reason, opened the door of an adjoining panel, and came in contact with a live part, sustaining a shock of one phase to earth. The accident was due to deceased's lack of ordinary care.

At Shettleston Colliery, Lanark, a foreman brusher was killed by an electric shock which he received on touching a flexible metallic tube containing the connecting leads between a pump motor and its switch box. The tubing appears to have become charged from the switch box, which must have been in contact with an incoming lead. The hole admitting the leads was not bushed and had sharp edges, and the box itself was not properly connected to earth. Proceedings were subsequently taken against the manager and electrician; both pleaded guilty, and were fined. Three-phase system, 440 volts. Neutral point earthed.

At Risca Colliery, Monmouthshire, when switching on the mill motor, deceased's wrist came into contact with the switch box, which was "live," due to the current passing through the medium of carbonised waste, from a line contact stud to the switch-box cover. The system was 650 volts A.C., three-phase. The switch box was not earthed, and was thus working in contravention of the Factory and Workshop Act Electricity Regulations, No. 21. The electrician was prosecuted, and was ordered to pay £5 5s. towards costs.

At Hazelrigg Colliery, Northumberland, an apprentice fitter, without authority, opened an electric controller having a pressure of 3,000 volts alternating, before cutting off the main switch, and either stumbled against the main contacts, or, in a moment of forgetfulness, touched one of them to wipe off the oil, when he received a fatal shock.

Further progress has also been made in the installation of electric safety lamps, 126,784 being in use at the end of 1916, against 95,167 in use at the end of 1915, showing an increase of 31,617. The total number of flame safety lamps was 610,821 lamps, or an increase of 9,733 over the year 1915, from which it would appear that the electric lamp is gaining in popularity. There can be no doubt that the electric lamp tends to safety and efficiency. The numbers used in the various Inspection Divisions are given below:—

Division.	Number in use.	Method of locking.			
		Lead rivet.	Magnetic.	Screw.	Other.
Scotland ...	5,640	424	5,172	6	38
Northern ...	8,542	2,764	5.765	—	13
York. and North Midland	56,192	5,623	50,483	3	83
Lancashire, N'th. Wales & Ireland	4,515	1,601	2,898	16	—
South Wales ...	49,909	1,499	48,403	—	7
Midland & S'thern	1,986	972	925	32	57
Total	126,784	12.883	113.646	57	198
Total in 1915...	95,167	11.482	83,485	25	175

The chief interest in the above table lies in the great number in use in the South Wales coalfield, which shows that their efficiency and tendency to safety from explosion is very much appreciated. In Yorkshire many of the new collieries in the Doncaster area have adopted the electric lamp from the start, whereas in South Wales the introduction of the electric lamp meant the displacement of the old oil lamp.

In conclusion, it may also be noted that more than half the flame safety lamps are lighted by electricity, and that more than half the shots fired for blasting the coal or stone were fired by electricity.

THE CONTROL OF LARGE AMOUNTS OF POWER.

Discussion at Bristol.

Mr. E. Basil Wedmore read his paper on this subject at the meeting of the Western Local Section of the Institution of Electrical Engineers on March 11th. A report of the discussion is given below.

The Chairman, Mr. H. T. Rogers, said that the report of the Coal Conservation Sub-Committee led up to all kinds of industrial questions, principally on the securing of output. If we could not get more output, higher wages could not be paid. It was, therefore, obvious that some steps must be taken to give the nation a cheaper supply of power than we had at present.

Mr. W. A. Chamen said that the problem happened to interest him at the present time most particularly. He began to see a question whether under certain circumstances it was right to put down one large generating set to deal with certain output, or whether it should not be sub-divided. The point required careful consideration. Mr. Wedmore said that in modern practice, where the mid-point of the system was earthed all faults to earth would be cleared without serious voltage disturbance, and the large majority of cable faults were of this character. It happened that he had had trouble with earth resistance on a neutral, and was rather hoping that as soon as he put in neutral resistances the trouble would cease; he had now had to put reactances into each of the alternators. There was no need for the earth resistance on the neutral. Mr. Wedmore did not lead them to hope that reactances in the phases would enable them to do away with the resistance in the neutral, the thing they would be glad to be rid of.

Mr. S. F. Walker (Bath) asked why they should not deal with every source of power that they could get, and deliver it all to one system of cable running North and South, East and West, tapping every source of power. Everybody everywhere who wanted light or power would get it from the cables near by, and get it in the form most economical. Put in reactance, and things would go on all right.

Mr. H. Faraday Proctor (Bristol) pointed out that the interim report of the Coal Conservation Sub-Committee did not suggest that there should be 16 generating stations, only that the country should be divided up into 16 generation areas. There might be half-a-dozen stations in each of these areas. The suggestion for 16 areas was put forward by the Linking-up Committee some 18 months ago.

Mr. W. Nairn (Bristol) said that so long as the distribution system was sound there was no difficulty in handling on the network the 100,000 k.v.a. which the author took as his typical station output, the difficulties only arising when a fault occurred on the system, and he suggested that the matter of primary importance was to have reliable protective gear installed which would disconnect the fault as speedily as possible, the reactances having only a secondary duty, viz., to stem the rush of current to the fault until the protective gear had done its work. Faults which occurred on the mains could be dealt with by the Merz-Price and Merz-Hunter protective systems, but he knew of no protective gear which would prevent bus-bar faults being thrown back on to the power-station overload relays. Fixed time-limit relays with graded settings were useless outside the power station for clearing such faults. If, then, such faults could not be cleared locally it followed that bus-bar faults would shut down the entire network until located and cleared by hand, and he suggested that the question of bus-bar faults was another of the limiting factors in the extension of super-networks. He believed that to ensure a reliable supply, it was necessary to divide the network into rings of reasonable capacity, not solidly linked together, and if power was to be inter-changed between power stations of large size, it should be done through separate trunk feeders, and not through the network. He would not consider it safe to handle such a large load as 50,000 k.v.a. with only one set running. A fault on the set, or even a minor defect on the auxiliary plant, might shut down the set, and when they considered that the capacity of this one set was capable of handling the present-day maximum demand of a city like Manchester, they could form some idea of the inconvenience which would be caused. Not less than three units of suitable size should be used on such a load, and if one dropped out, the remaining two units would at least maintain an impaired supply until the spare machine was switched in. As soon as makers ceased attributing breakdowns of generators to faults on the external circuits, so soon would power-station engineers be only too pleased to dispense with the external reactance.

Mr. I. A. D. Pedler (Bristol) asked whether the author would consider it practicable to install impedance coils in the circuits of separate feeders provided they were normally short-circuited with an oil-switch, the maximum cut-out of which should be devoid of any time limit, so that in the event of a rush of current due to a fault the oil-switch would open immediately, giving the desired choking effect as afforded by an impedance coil before the rush of current rose to its maximum.

Mr. C. T. Allan said he had experienced less trouble with pole lines than with underground cables, and was of opinion that external reactance was of little use because of step-down transformers. He was glad to notice that it was the tendency of manufacturers to increase the sub-division of switchgear. He would prefer to take impedance out of feeders.

The Author briefly replied to some of the points raised, reserving his full reply for the *Journal*.

Discussion at Birmingham.

The paper was read and discussed before the Birmingham Local Section on March 20th.

Dr. C. C. Garrard said the question of the strength of short-circuit currents and the capacity of the protective gear to deal with them was of extreme interest, and was very little understood. It would appear that the author advocated a sufficient reactance in the generator circuit, coupled with sectionalising reactances (*i.e.*, reactance in parallel). He relied for series reactance upon the inherent reactance of the system, suitably arranging the feeders, &c., to this end. He thought that the type of apparatus (reactance coil) shown in the paper was the last thing any engineer would install in his station if he could possibly help it; he referred particularly to the exposure of such a large amount of bare metal at high voltages. If the whole thing were put in a steel tank and filled up with oil it would be a much better arrangement. He could not agree that it was an advantage to employ a design in which all parts were fully open to inspection. If the reactance coil were in a steel tank, however, it would be necessary to provide it with an iron core, and this rendered the arrangement difficult for feeder reactances, where the short-circuit current might be 30 times the normal full-load current through the coil. For bus-bar and generator reactances, however, the short-circuit current would not generally exceed ten times the normal current, and this would allow iron-cored coils to be used. He did not agree that the limiting feature with regard to the extension of supply systems was in the distribution system rather than in the generating station. Certainly a limit was reached if unsuitable distribution apparatus were used. The trouble could be overcome in the distribution system by an improvement of known apparatus, and as far as the distribution was concerned it was *possible* to do without reactances. As regarded the generating station, however, he thought that reactances were absolutely necessary. Thus, the true limiting feature was within the generating station. An objection had been raised in some quarters as regarded the type of switch in fig. 7 in that the moving contacts moved upwards in the oil, and thus the head of oil was continually diminishing during the operation of breaking circuit. In the type shown in fig. 30 [E.R. fig. 11] the moving parts of the switch moved downwards, and thus the head of oil increased. Moreover, with the latter type of switch the rush of current on short circuit tended to open the circuit quicker by increasing the repulsive force tending to press the moving contact downwards.

Mr. W. Wilson said the paper was of special interest in that the greater portion of it dealt with a simple piece of apparatus, with no moving parts or other complication to get out of order or to cause expense. It was to be hoped that an extension of this principle would be possible in the near future. With regard to the external effect of the reactance coils, he asked what was the extent to which the passage of the flux was felt in the vicinity; it was conceivable that a portion of the iron framing of the building might come within the field, and trouble might be caused thereby in several ways. Probably the reactances being arranged in groups of three permitted the phases largely to neutralise one another as far as stray flux was concerned. He did not understand the emphatic importance that the author attached to the exposed nature of the pattern illustrated. It seemed to him that the danger attending the exposure of these high-tension conductors was a definite weakness, and that some kind of cover was not only justified, but necessary.

Mr. R. A. Chattock agreed that the large supply systems now being built up made an effective control much more difficult to obtain, and this difficulty would probably increase in the future. There was no doubt that the use of reactance made regulation of the pressure more difficult. It therefore seemed desirable to consider if the current could not be limited in some other way. The extension of the areas of supply would also require higher pressures to be used for distribution, and voltages of 20,000 to 30,000 would probably be employed. If the switching were done at these pressures, the amount of current to be controlled would be far less than at pressures of 6,000 volts, and this should render the use of reactances in and beyond the bus-bars less necessary. He thought that it would probably be found that reactance could be confined to the alternators and to the transformers, which would be external to them, but would constitute with them one generator unit. He agreed that reactance was necessary here, partly for the protection of the machines themselves, and partly to prevent excessive rushes of current into faults on the system, but he deprecated the use of reactances in the bus-bars. He did not think a momentary interference with the voltage would matter as long as the switches could be relied upon to operate properly. The author referred to the use of selective protective apparatus, and stated that this threw a severe duty upon the switchgear. Surely this was not the case on an earthed system with a limiting resistance; nearly all faults were primarily earth faults which often developed into short circuits between phases, and if the selective apparatus could cut out the faulty section while its fault current was limited, the strain on the switchgear would be easily met. Again, the balanced-current protection as applied to split-conductor cables enabled faults to be eliminated before the current values had got out of hand. The development of these methods would seem desirable before adopting the use of reactances in the distributing system. It was generally proposed to link up these large stations by substantial links, and in this way one spare should be sufficient in each station, as it could serve perhaps several stations.

SWITCHGEAR STANDARDISATION.

Discussion at Newcastle.

Dr. C. C. Garrard read his paper on the subject of "Switchgear Standardisation" at a meeting of the Newcastle-upon-Tyne Local Section of the Institution of Electrical Engineers on March 11th.

The Chairman (Mr. A. H. Marshall), in opening the discussion, said the question was undoubtedly one of great importance, especially in regard to the smaller sizes and lower voltages, and he thought that it was just in that matter that the work of a proving-house would come in. In regard to the development of high-tension gear for large powers, he was hoping that before long the Institution would entrust them in that area with some portion of the research work that was being carried on. In no part of England were there greater facilities available than in this district.

Mr. Gregory said he thought they would all agree that standardisation would increase their output, and thus further one of their great objects. While he thought it was desirable to standardise apparatus that satisfied present-day requirements, and was likely to satisfy the wants of the future, having a view to the development of power supply, that course should not be adopted in regard to apparatus that did not, and was not likely to, satisfy requirements. In regard to high-tension switchgear of the cubicle type, he attributed to the bare conductors nine-tenths of the troubles that arose. When they adopted standards they should not be mere imitations of American or German standards.

Mr. H. W. Clothier, in a written contribution, agreed as to the desirability of standardisation, but urged that it must not be carried out in such a manner as to put an embargo on the inventive ability of the individual. The need for a regular revision of standards should be acknowledged, but such revisions should not be under the sole control of either a monopoly, or even a majority of parties with vested interests. He thought that a standard specification must allow a certain amount of latitude, possibly by the inclusion of alternatives, and also they must take care they did not sacrifice any of our national characteristics in design by trusting too much to the example of practices set by their competitors. It was a natural, but dangerous, tendency to take an established set of rules, such as those prepared by the V.D.E., and to rely too much upon them. Despite the specifications, publications, and advertised testing plant, he believed we had British experience of the best kind to direct our developments. No amount of testing plant could tell so much as a really bad short-circuit on systems such as there were in that district, with over 100,000 kw. of plant connected in parallel on one huge network. The author had mentioned lightning arresters invented in England, but developed in America. He contended that this was an instance of the advanced state of the science in Great Britain. Lightning arresters had been developed in this district, practically out of experience, which was the ideal. To imagine that any puny apparatus they might make would arrest lightning was the wrong way to approach the subject. The effect of lightning was to put a short-circuit upon that section of the line nearest to the part struck. All apparatus, including transformers and switchgear, therefore, must have the requisite strength to withstand the short-circuit. The development of suitable switchgear and protective devices, which must be there in any case to deal with other kinds of short circuits, seemed to be the best method of dealing with the effects of lightning. As to the "most beneficial principles of high-tension switchgear construction," in the course of evolution they had come to the complete enclosure of all conductors within metal, which was a step in advance of the enclosure on three sides only, as obtained by the usual cellular construction.

Mr. Collins, referring to the American standardisation rule for test pressures for switchgear, said one objection to it was that it sacrificed the factor of safety. In this country, with its comparatively dense cable system, a pressure rise during the switching operation was practically unknown. As to the curve connecting the total length of break and voltage in oil switches, he thought the figures differed very widely. In regard to the speed of operation of oil circuit-breakers, the writer of the paper only mentioned two points, but he thought there was a third one—and still more important—the inherent time lag of the switch. This had a considerable bearing on the rating of the switch.

Mr. Longman inquired, in the case of knife-switches, whether the heating they sometimes observed could not be obviated if the knife were curved, and made slightly slanting, thereby having the advantage of air through the contacts.

Dr. Thornton said he thought the paper was an excellent example of some of the preliminary work that lay before them. As to the attitude of the Government in regard to investigation, he thought the Government would find money if the manufacturers would find half. He was perfectly certain that the work could not be done at the Physical Laboratory, but could be done, say, in Newcastle or in Birmingham. As to the amount of oil required for an oil-switch, and the statement that "it is to be assumed from first principles that the more oil there is the greater the breaking capacity," he could not see why that should be. He thought it was a question of heat, the quantity of oil did not matter a bit. In regard to the internal explosions referred to by the author, he thought that cases in which explosions in oil-switches were due to gas were rare, and his own opinion was that they were due to some other cause.

Dr. Beard was of opinion that there should not be too much haste in standardisation of switchgear. He could not say that he agreed with the tests mentioned, and in regard to switchgear, he thought tests ought to be on the basis of at least three times the rated voltage. They might, too, with advantage standardise the nomenclature.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

4,749. "Signalling apparatus for automatic telephone system." A. E. Stevens. March 18th

4,750. "Contact-making and breaking apparatus." British Thomson-Houston Co. & H. K. Trechmann. March 18th.

4,758. "Dynamo-electric machines." G. Plaisant. March 18th.

4,759. "Ignition systems and dynamos." E. C. R. Marks (Splitdorf Electrical Co., U.S.A.) March 18th.

4,760. "Spark plug and method of manufacturing same." F. M. Furber. March 18th. (U.S.A., March 17th, 1917.)

4,775. "Protective devices for alternating-current distributing systems." L. Andrews. March 18th.

4,786. "Portable electric hand lamp." A. H. Rickett. March 19th.

4,787. "Electric hand lamps." W. A. Harris & H. Leason. March 19th.

4,795. "Electric motors." T. Preece. March 19th.

4,840. "Controlling mechanism for electrically-driven air compressors, pumps &c." J. J. Ash & British Thomson-Houston Co. March 19th.

4,841. "Electric arc furnaces." J. J. Ash & British Thomson-Houston Co. March 19th.

4,866. "Dry electric batteries and method of making same." W. J. Mellersh-Jackson (Burgess Battery Co., U.S.A.). March 19th.

4,868. "Electric heating by high-frequency currents." Ajax Metal Co. March 19th. (U.S.A., September 19th, 1917.)

4,869, 4,870. "Magneto-electric machines." A. M. Allen & R. B. North. March 19th.

4,933. "Vacuum tubes." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 20th.

4,935. "Electric installations." G. A. Beauvais. March 20th. (France, December 14th, 1917.)

4,936. "Transmission of telephone, telegraph, &c., signals." G. A. Beauvais. March 20th. (France, December 14th, 1917.)

4,939. "Electric motor controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 20th.

4,952. "Electric relays." D. A. Christian. March 20th.

4,965. "Electric switches." J. W. Drake & Drakes, Ltd. March 21st.

4,970. "Electrical fire bars." H. H Cressall & Cressall Manufacturing Co. March 21st.

4,990. "Electric lighting of machines driven by electric motors." V. Hope. March 21st.

5,009. "Dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 21st.

5,010. "Automatic telephone systems." Automatic Telephone Manufacturing Co. March 21st. (U.S.A., July 9th, 1917.)

5,032. "Means for indicating condition of charge of secondary batteries." G. C. Evans. March 21st.

5,059. "Fittings of gas and electric lamps." F. Westwood & H. B. Westwood. March 22nd.

5,079. "Electrical recording graph." T. H. Escott, W. Leeming & R. G. Horton. March 22nd.

5,094. "Control of lamp circuits used on motor-cycles, motor-cars, &c." A. H. Midgley and C. A. Vandervell & Co. March 22nd.

5,109/5,110. "Electric motor controllers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 22nd.

5,123. "Couplings for magnetos of internal-combustion engines, &c." A. A. Remington. March 23rd

5,131. "Portable electric lamp." G. E. Moore. March 23rd.

5,173. "Commutator brushes of electric motors." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. March 23rd.

5,181. "Sparking plugs" Soc. Generale des Huiles et Fournitures Industrielles l'Oleo. March 23rd. (France, October 15th, 1917.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1916.

13,304. High-tension Electric Current Collecting and Transmitting or Conducting Devices of Ignition Magnetos. Soc. Anon. Etablissements de Dion-Bouton November 8th, 1915. (102,140.)

17,161. Electric Incandescent Lamps. Hamburger L., D. Lely & Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 29th, 1916. (113,626.)

17,292. Electric Motors. T. L. R. Cooper. December 2nd, 1916. (113,627.)

1917.

3,551. Apparatus for the Purpose of the Direct Conversion of the Energy of Motion of a Dielectric into Electric Energy, and conversely for the Conversion of Electric Energy (of the right frequency) into the Motion of Mass. A. Young. March 10th, 1917. (113,697.)

3,768. Brush Gear for Dynamo-electric Machinery. Troup, Curtis & Co. and J. H. Wickett. March 15th, 1917. (113,686.)

4,464. Lanterns or Fittings for Incandescent Electric Lamps. H. T. Wilkinson & Wardle Engineering Co. March 28th, 1917. (113,698.)

5,088. Electric Switchboards. A. H. Railing & C. C. Garrard. April 11th, 1917. (113,705.)

8,659. Controlling or Regulating Devices for Electric Motors. Electric & Ordnance Accessories Co. and N. G. Langrish. June 16th, 1917. (113,729.)

9,024. Lubrication of Magneto-electric Machines. M. S. Conner & C. C. Puckette. June 23rd, 1917. (113,732.)

9,910. Electric Diaphragm, Horns, or Alarms. J. Bouteille. July 7th, 1916. (107,977.)

12,074. Contact Devices for Electrical Apparatus. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) August 22nd, 1917. (113,744.)

12,858. Telephone Systems. Western Electric Co. & L. Polinkowsky (partly Western Electric Co., U.S.A.). September 7th, 1917. (113,753.)

13,311. Armatures for Dynamo-electric Machines. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U S.A.) September 17th, 1917. (113,756.)

13,331. Holders for Electric Incandescent Lamps. C. Wirt. September 17th, 1917. (113,757.)

15,777. Electric Switches. J. C. Willcocks. October 30th, 1917. (113,765.)

16,465. Sparking Plug. J. J. Baron & E. A. Baron. November 9th, 1917. (113,770.)

17,218. Electric Motor-control Systems. British Westinghouse Electric and Manufacturing Co. November 22nd, 1916. (111,849.)

18,542. Spark Plugs. H. J. Berry. December 13th, 1917. (113,774.)

3,555. Systems of Ship Propulsion. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 10th, 1917. (113,680.)

17,312. Driving Arrangements of Electric Motors. G. Jones. November 23rd, 1917. (113.772.)

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NEW ENGINEERING INDUSTRIES.

THERE are so many committees engaged in considering some aspect or other of the operations of the industries in which readers of this journal are interested, that it is not unlikely that only a very few people in the electrical and engineering industries are able to keep themselves intelligently informed concerning even their existence and objects, much less their activities. We have no desire to institute a comparison respecting the importance and merits of our manifold committees; we can see good in them all, and recognise that, considered from some special standpoint, they are all important and have their place to fill in the great plans that the nation must be prepared to adopt in preparing for days to come. But while we may sympathise with all—though that need not be taken as saying that we express approval of the *personnel* of all—we recognise naturally enough that some of them are likely to be of direct and immediate benefit to the engineering and electrical industries if their work be well done. Now, we hold that no detached committee of individuals, even though they may each represent very large engineering companies or firms, can be qualified to advise with authority, unless they act in co-operation with the major part of the industries in whose interests they make their deliberations. Therefore, when we find one committee which has a very definite and practical duty laid upon it by the Ministry of Reconstruction, and that duty is one which may have great consequences for the engineering industries of the United Kingdom if the subject is wisely handled, we desire to urge the whole industry to regard this particular committee as one that stands apart from the general army of committees as being worthy of more than ordinary attention. We are referring to the Engineering Trades (New Industries) Committee, concerning which we gave some particulars in our issue of February 1st. We return to the matter now in case that mention of it may have been overlooked, and also because publicity among the industry itself is essential if the best results are to follow the Committee's endeavours.

The engineering operations in connection with the war have led to vast additions being made to works and to general manufacturing capacity, with the accompanying great increase in labour of all classes employed therein. When the war is finished and the Forces return to resume their former occupations, the new works will afford part of the accommodation required for employing the substitutional or additional labour which is now in possession. It is the principal function of this New Industries Committee to assist the engineering trade in dealing with this large problem of facilitating the establishment of new industries to occupy these works and this big volume of labour. The Committee desires to be informed by the trades generally, as well as by individual manufacturers, of all new projects for expansion of businesses after the war. This will serve two ends at least: it will make help as far as possible in securing supplies of materials; it may also be of use in securing that a number of concerns shall not separately concentrate their energies upon similar developments, so that after the war there is an unnecessarily large production of a particular class of article—possibly greatly in excess of actual or reasonably prospective requirements.

The members of the Committee are all connected with well-known engineering companies, and they bring to their work considerable practical experience of the industries. They invite their fellow manufacturers to communicate with them, stating what are the difficulties that they anticipate meeting in their efforts to extend their industries after the war. It is conceivable that the collection of their views might be of considerable help to the Government in its efforts for enabling industry to overcome such difficulties. With political issues, such as protective tariffs, the Committee has nothing to do, but it is obvious that, whatever else happens, manufacturers will be encouraged to rely upon their own efforts and upon good organisation and efficient management. In this connection, specialisation in manufacture will almost certainly be encouraged, and it may also be accepted that manufactures which involve the employment of a relatively large amount of labour to the cost of production will be regarded both by the Committee and by the Government with special favour.

It has been frequently pointed out that the inevitable shortage of materials for engineering work in the period immediately following the war will require that such materials as are available shall be for a time under Government control. It is quite within reason to suppose that a priority for materials for new or extended industries of a character approved by the New Engineering Industries Committee may be granted to some extent on that Committee's recommendations. We would recommend those who desire to place their views before the Committee, or wish to make inquiries on any points that we have not covered, to communicate with the Secretary of the Engineering Trades (New Industries) Committee, at Armament Buildings, Whitehall Place, S.W. 1.

Railway Electrification.

Many things have happened since the war began, to emphasise the importance of the question of converting our steam railways to electric traction—things of the most diverse character, but all, without exception, tending to the same conclusion. The limitations of our space forbid us to elaborate the subject, but we may profitably draw attention to a few of these concurrent factors, the pressure of which is constantly increasing in the aggregate.

First, of course, we may place the success which has invariably attended the adoption of electric traction on any important stretch of railway in this country, both before and during the war; secondly, but second only on account of distance, the corresponding successes which have been achieved abroad, especially by the great main-line undertakings in the United States, which have riveted the attention of the world's railway engineers upon this question; thirdly, the difficulty of handling suburban traffic at city termini, which has compelled the Great Eastern Railway, for example, by the mouth of Colonel Thornton, to admit the absolute *necessity* of electrification, even at the cost of excavating a huge underground station; fourthly, the shortage of coal, to which we refer later; and lastly, the coming reorganisation of electricity supply on the grand scale in this country.

Almost all of these points have cropped up separately at different times; on this occasion we wish particularly to direct attention to the last two items, which are, in fact, inseparable. According to Mr. E. W. Rice, President of the American I.E.E., whose address we quote elsewhere in this issue, if the American railways had been generally electrified, the coal famine from which the United States has lately suffered would have been largely, if not wholly, prevented, for the railways could have handled 50 per cent. more traffic, two-thirds of the coal consumed by the railways would have been saved, the decreased haulage of coal for this purpose would have set free another 10 per cent. of traffic capacity, and water-power could have been utilised. Every one of these arguments but the very last applies equally to this country. Further, when the railways are electrified, they will constitute one of the most important loads on the big power stations; this point must be borne in mind in locating the latter—and, still more important, the railways must be discouraged from putting down power stations of their own, on that individualistic plan which has so absurdly and unfortunately characterised not only some of our railways, but also, by a singular confusion of ideas, our municipal supply undertakings. Is it not extraordinary that the growth of socialistic, or, at least, communistic, ideas in the past century, which led to the municipalisation of electricity supply, also brought about the jealous isolation of each municipal undertaking from its neighbours? The parochial ideas from which we have suffered in the past must not be allowed to prevail in the future; we must all think co-operatively, and seek the welfare of the whole community rather than our own restricted ends, in the electrification of our railways as in other national affairs.

The I.E.E. and Foreign Trade.

We have so often and so urgently pressed upon our readers the imperative necessity of organising ourselves, in order to develop our foreign trade directly our hands are freed by the cessation of hostilities, that we feel somewhat diffident in returning to the subject yet again. We have, however, at least two excellent reasons for doing so to-day, as we shall show. The occasion is the fact that an extra meeting of the Institution of Electrical Engineers is to be held next week (Thursday, April 18th) to hear and discuss a paper by Mr. Leonard Andrews, entitled "The Overseas Distribution of Engineering Appliances."

In the first place, the acceptance of a paper which deals wholly and solely with a subject which is essentially commercial, and the calling of a special meeting to discuss it, is an event which almost marks an epoch in the history of the Institution. We need not labour the point; during the war the Council has given many indications of broadening views, and we welcome its recognition, belated though it be, of the fact that its responsibilities relate not only to the technical affairs of the electrical industry, but also to the trade upon which that industry depends for its existence. The Institution of Civil Engineers led the way last year when it invited Mr. Edgar Crammond to address it on the subject of foreign trade, and we congratulate the I.E.E. on its coming into line with the senior Institution.

In the second place, while we must not infringe the ancient tradition, long ago swept away with other dusty relics of the past by our American comrades, that the contents of a forthcoming paper are strictly secret (except, of course, to those who apply for copies in advance!—where is our consistency?), we need not conceal the fact that we are aware of its contents, and, while we must defer comment and criticism for the moment, we may say that it is a remarkably bold conception, a gigantic scheme, which will afford abundance of material for a lively and entertaining discussion that will not be confined to the four walls of the theatre in Gt. George Street. Mr. Andrews is no mere theorist in this connection; he has gained experience of priceless value, and extending over many years, in the very field with which his paper deals, and we hardly need say that an enthusiast with expert knowledge of his subject is always interesting and instructive, whether we agree with him or not. We suggest, therefore, that next Thursday's meeting will be well worth attending, from every point of view.

NATIONAL ELECTRICITY SUPPLY.

By A POWER STATION ENGINEER.

(*Concluded from page* 319.)

A difference in views exists in regard to the exercise of powers by a District Board in connection with (1) the construction of new power stations, (2) the responsibility for extending existing plants, and (3) the right to shut down an existing plant. The balance of opinion would, I think, favour the Board being entrusted with (1), although an alternative suggestion has been made that this work should not be carried out by a District Board, but by a small Joint Board consisting of two or more neighbouring authorities. Many undertakings look with alarm upon the proposals contained under (2) and (3), as these would seriously encroach upon existing rights. In effect, they say that if the National Scheme, with its large power stations, is justified, then the authority responsible for such a scheme must demonstrate by the low prices charged for bulk supplies that it will not pay either to extend or to run existing local plants. They are prepared to take part in any local interconnecting scheme so as to make better use of existing stand-by plants and to reduce the wastage of fuel due to light-load running; but will not agree to place in other hands the right to interfere with the internal management of the local power station. They further point out that some of the existing stations either contain economical modern plant or are capable of being remodelled at a comparatively low cost so as to produce much better results. It will, therefore, be possible, even under the existing conditions, to reduce the costs to a lower figure than can be obtained if a large portion of the existing capital is rendered unremunerative through the shutting-down of power stations, and additional capital charges brought into the cost sheet by purchasing from an outside source. In other words, the costs due to excessive capital expenditure on wholly or partially duplicated plant and transmission lines will be appreciably higher than any possible saving due to more economical generation on a larger scale.

There are, I think, two main points to bear in mind when considering the matter. The first is that efficiency cannot be obtained from a new station containing large units of plant unless an assured load is secured when the plant is ready for use. The second is that the maximum benefits cannot result from any scheme of co-operation amongst a number of undertakings if they retain the independent management of their local power stations, as each undertaking naturally considers its own interests first, irrespective of the effect on neighbouring authorities. A District Board owning and operating all the power stations will be better able to judge how any given area can be supplied under the most economical conditions than would those responsible for a single undertaking, as the spirit of rivalry or jealousy between one and another adjacent authorities, which is so often liable to influence decisions, will be entirely eliminated.

When an existing power station possessing economical modern plant is acquired by the District Board, it may be necessary to provide safeguards to ensure that the cost of the supply given subsequently by the Board shall not exceed the cost previously incurred. There are not, however, likely to be many cases of this kind, as all efficient plant will be utilised, and in certain instances extended, by the Board. It is the small and inefficient plant that must be shut down in the first place to provide the load for the new power stations. A considerable reduction in costs must result not only in capital expenditure, but in operating expenses, if extensions, which under present conditions are carried out by a number of undertakings, are pooled and provided on one site only. The new stations will be used in conjunction with existing efficient plants, the latter being run at or about full load during factory hours, say, between 6 a.m. and 5.30 p.m., Monday to Friday inclusive, and 6 a.m. and 12 noon on Saturday, leaving the new stations to deal with the combined light loads of a number of undertakings during the remaining hours of the week. Under these circumstances, the best possible use will be made of the existing capital expenditure on the plant, and, consequently, the savings effected, after allowing for transmission losses, will be more than sufficient to ensure that the prices paid by existing consumers will not be increased, but appreciably reduced.

Regarding the proposal put forward by certain parties that all the advantages claimed for ownership and operation by a District Board can be obtained by co-operation on an interconnected system, I am absolutely in agreement with the finding of the Coal Conservation Sub-Committee that interconnecting is only one small step in the direction of securing a cheap and adequate supply. Apart from its inadequacy, I consider that such a scheme, under separate ownership, is altogether unworkable in practice. To take an analogous case, imagine two separate manufacturing concerns, A and B, established adjacent to one another, both producing the same type of article. During one day, or week, or month A's output is seriously reduced owing to a breakdown, and B makes up the deficiency by using his equipment. A short time later the position is reversed, and A has to turn out the goods which B cannot produce. A little later still A has to execute more orders than he can deal with, and is not able at the time to extend his premises, but B is able to do so, and the goods are delivered. At a still later date there is a general shortage of orders both for A and B, and they decide that, instead of them both working half-time, A shall entirely shut down, and B shall work full time. Does any plain business man seriously think that, under such conditions, A and B are perpetually going to adjust the charges for services which one renders to the other, and continue to carry on under independent ownership and separate management? The one and only course for them to adopt is to amalgamate their interests, and continue as one undertaking. An exactly similar course will have to be adopted by authorities at present operating power stations if interconnecting is to be really effective.

Having outlined the different types of District Boards to whom the State might delegate the control of all existing power stations and main transmission lines, it will be useful to ascertain what interests are principally concerned in the efficient exercise of such powers. These will be:—(1) The State taking the part of the capitalist; (2) the authorised distributors as purchasers of the supply on the lowest possible terms; and (3) the large industrial consumers who depend on a cheap and adequate supply to maintain their commercial supremacy.

A District Board on which these three important interests are represented by men of ability may fairly be considered to possess those qualifications which will make it thoroughly efficient and reliable. In regard to numbers, a fair division would be one-third nominated or elected by each of the interests mentioned. The members nominated under (1) would be selected by the head of the Government Department concerned in electrical matters. Under (2) the representatives would be elected by each of the undertakings exercising distributing powers in the district, or, in the event of the number being inconveniently large, the undertakings would combine in groups for the purpose. The nomination under (3) would be made by Chambers of Commerce, manufacturing combines, employers' federations, and, in view of the Whitley Report, possibly also by engineering and allied Trade Unions. An alternative to the method suggested would be for all those representing particular interests to be specially selected and nominated by the Government Department.

In the event of all the power stations and main transmission lines in the country being acquired by the State, the sale of the undertakings belonging to local authorities will be facilitated by reason of the fact that the transfer will only be from a body of local ratepayers to a larger body of Imperial taxpayers. The responsibility for the capital expenditure will still rest upon the shoulders of the general public. The acquisition of the company undertakings may be more difficult, as the value of goodwill and future profits will influence the terms, particularly in those cases where the powers to operate have been granted in perpetuity and considerable sums have been spent in anticipation of future demands.

Assuming that the purchase is completed at or about a figure represented by the present capital commitments, it will only be a transfer of capital and obligations incidental thereto from one set of proprietors to another. It does not involve the creation of fresh capital for the purpose.

THE PROMULGATION OF IMPROVEMENTS IN DESIGN AND MANUFACTURE.

By "IMPRIMATUR."

Prior to the formation of trade associations, one of the chief features of competition between the individual firms engaged in an industry was the selling price. Competitors endeavoured to obtain orders on the basis of giving more for less money, an invidious rivalry which often led to the deterioration of the industry's productions—to the cheap and nasty form. In many cases, since improvements could only be adopted with an accompanying increase in selling price, manufacturers were restrained from improving a production beyond its accepted minimum marketable condition.

If an improvement was ever adopted, the maximum recompense was lost to the pioneer because of the accepted principle that it was necessary to conceal the improvement as much as possible from rivals, with the outcome that a considerable time elapsed before the improvement percolated to likely customers. Meanwhile, if a competitor was determined to produce an imitation, there was plenty of time for that object to be accomplished, and then it was difficult to decide to whom the credit for the original idea was due; the imitator could indignantly dispute priority, and secure orders to the detriment of the originator. So long as this illogical policy of secrecy was upheld, there was not much incentive to progress in design, even when it did not signify an increase in selling price.

The establishment of industrial or trade associations pledged to adopt a common policy has practically abolished price rivalry, with resultant benefit to both buyer and manufacturer. The tendency is to raise the quality of the industry's products, and although the selling price may be increased, the quality is increased to a greater degree.

But having subdued an unwholesome form of competition by means of co-operation through industrial associations, it would be unfortunate if co-operation in industries should be the cause of the cessation of competition in other directions. The natural corollary would be a combine, with the consequent deterioration of the industry's products from that high standard which healthy and legitimate competition produces.

Individualistic competition must be continued if the productions of an industry are to be kept continually on the up-grade in efficiency of design and manufacture.

With the introduction of trade associations, the buyer has the choice from half a dozen productions, each guaranteed under the same conditions and sold at very much the same price. How, then, is a preferential purchase to be made? If the articles are produced to operate under standard conditions, the materials used in their manufacture will be more or less of the same quality, so that the chief considerations will resolve into the particular manner in which the materials are adapted to form the product and the processes the materials go through in the factory—in other words, development of design and methods of manufacture. The publicity policy of individual manufacturing organisations must, therefore, be based principally on these features, so that probable buyers will be informed of the superior details of design, and of the modern and efficient methods by which the design is manufactured.

This policy necessarily includes the immediate announcement and utmost publicity of improvements if the maximum reward is to be obtained for their introduction. Trade associations have removed the cause, if any existed, for the policy of secrecy, and if doubt still remains it is based on a fallacy. Before competitors can incorporate the improvement in some other guise into their productions, the original producer will have reaped the benefit by the promulgation of the improvement immediately it is ready for the market.

Organised publicity methods will inform the buying public of the original development, and to whom it is due, and palpable imitations which follow will be recognised. The disciples of imitation will be discredited by never being up-to-date, whilst the manufacturer, who creates improvements and immediately publishes them, will build up a valuable commercial asset in the reputation for producing articles of improved design in advance of competitors. It follows, then, that the special features which distinguish the designs of similar productions of the several firms in an industry enter largely into the selling element.

New methods of manufacture must also be given greater publicity to inform the buying public of the characteristic methods of manufacturing a particular product, and thus provide evidence of its reliability and proof that it is the result of the best practice of that particular industry. If competitors adopt a similar practice, it will only be after a lapse of time necessary to adapt the factory to the change, and, meanwhile, the originator has had ample time to obtain a return for his ingenuity if the information has been distributed by suitable publicity. By adopting a policy of publicity relating to design and manufacture, the buying public will identify a production by the characteristic features of the design, and by the methods of manufacture peculiar to that design.

The market for an industry's productions is divided into sections; to one section one particular production will appeal, to some other section another. These sections owe their origin, not to the manufacturer, but to the buyer. A manufacturer creates a market when he offers to the public a production which hitherto has not been used, and induces the public to buy it; but when competitors appear producing similar articles, it is the buyers, now with a variety of designs from which to choose, who form the sectional markets for each similar production. According to John Stuart Mill, the reasons which should govern the making of a choice depend upon the exercise of "the human faculties of perception, judgment, discriminative feeling, mental activity, and even moral preference." Under the co-operative conditions fostered by trade associations, an industry's productions do not demand the exercise of all these faculties, so that moral or instinctive preference will probably be a chief faculty exercised in making a selection.

It is the object of a manufacturer's publicity organisation to attract buyers from one section of a market into that section which favours his productions. This competition tends to perfection of design, as it gives a stimulus to each manufacturer in an industry to employ the best skill both for designing the production and for devising methods of manufacture, and the improvements provide the subject matter for original publicity methods to make them manifest. For general engineering purposes that publicity should be cultivated which will incite the mental activity of buyers, influence their discriminative feeling, and persuade them to doubt the moral preference they may have for some other production; and it must be persistent. Kindle the fire of doubt and persistent publicity will fan the flame!

Collective publicity is another form of co-operation which industries are being urged to adopt. There is undoubtedly a field for co-operative publicity, but it is limited to the circumstances where an industrial association, acting as an individual, adopts a general form of publicity to be absorbed by the public, *en masse*, as an individual. Under these conditions, a trade association is in the same circumstances as an individual manufacturer, and has as competitors other similar associations. If the association includes the whole industry of a country, then it is the like industries of other countries which are the competitors, and the nations are the individual buyers. Price will then be the chief feature of competition, and the inference is that international federations of industrial associations will eventually develop, and international industrial associations offer a firm foundation on which a practical "League of Nations" could be built up.

Under the accepted competitive conditions, however, the adoption of collective publicity would be advisable as an introductory measure to create foreign markets for the purpose of increasing the export trade of an industry. But to secure and hold a section of buyers for individual productions, each manufacturer must organise appropriate publicity applicable to his distinctive productions.

Collective publicity of a trade association in the country in which the industry is situated is of doubtful utility considering the cost, other than when it is organised to counterblast the efforts of a foreign invader, and even then it is an open question if suitably-organised individual publicity would not be more effective. Collective publicity is only efficient when the productions which form the subject of the campaign have no distinguishing features one from the other.

Individual publicity is an absolute necessity wherewith to induce buyers into the sectional markets favourable to individual designs, and this publicity will obviously have more effect when issued "straight from the stable" than when it forms but an item of the co-operative publicity-punter's "selections."

The proposed scheme for the reorganisation of electricity supply undertakings into a small number of large central stations, if carried out, will not lessen the need for organised publicity in this direction. In fact, to obtain satisfactory results from such a scheme, effective concentrated publicity will be necessary; but a co-operative publicity campaign does not present convincing indications of success. Such a campaign would suffer from the inherent restrictions indicated above, although there can hardly be any claim to characteristic designs in electricity. But there are characteristics peculiar to districts which would have the same effect. As an example, the publicity propaganda suitable for Birmingham could not be effectively applied to Glasgow. The housing conditions differ materially, to say nothing of the difference in temperament of those who live in the houses. The organisation of an "electricity supply" publicity campaign would require to adapt the methods of publicity to the peculiarities of the district and its inhabitants, consequently the publicity matter could be arranged more effectively on the spot where facilities are at hand for acquiring data on local conditions, so that each electricity supply centre would obtain much more substantial and competent service from its own publicity organisation than from any collective publicity campaign.

The organisation of *simultaneous* publicity campaigns offers many advantages, with much greater prospects of success than collective publicity. A Committee of the industrial association or supply centres could prepare a programme of subjects to which it was desirable to give widespread publicity, with dates arranged and agreed upon to be devoted exclusively to each item. With the programme as a guide, each individual publicity department would arrange matter and advertisements, which would be identical in topic, although distinctive in treatment, and by adhering to the precepts of the programme, advertisements and amplifying publicity matter would appear simultaneously, each successive issue being devoted to a particular item of interest. If overlapping should occur, it would be more of a desideratum than a drawback; the display of individual methods employed in approaching similar subjects would divert the reader and arouse greater interest. Let publicity work be overlapped if it may not be overlooked.

With collective publicity the tendency is to adopt large intermittent advertisements, whereas with simultaneous publicity there would be a variety of medium-sized advertisements. Research into the psychology of advertisements has proved that the persistent repetition of a portion-of-a-page advertisement is much more effective than an intermittent full-page advertisement.

Again, as previously explained, the lucubrations of collective publicity would not provide the necessary information to enable intending customers to choose which manufacturer's production was preferable, whereas simultaneous individual publicity would offer at the outset a collection on which the probable buyer's selective faculties could be exercised to make an initial choice. Thus by simultaneous publicity the object of collective publicity would be achieved, whilst individual publicity, with its discriminative attributes, would be utilised.

Magneto Manufacture in Sweden.—The Priorverken Aktiebolag, of Nörrköping, Sweden, has recently commenced the manufacture of magnetos and sparking plugs for ignition purposes on petrol motor vehicles.

WRECK OF A 35,000-KW. TURBINE.*

A 35,000-KW., 20-stage, 1,500-R.P.M., 25-cycle horizontal single-cylinder impulse steam turbine in the O Street Station of the Boston Elevated Railway Co. was completely disabled and seriously damaged while in service on February 14th, 1918. There were no casualties, and no one was injured. A distorted cast-iron diaphragm in the 18th stage presumably fouled the 18th wheel, breaking off the buckets, after which the buckets and diaphragms from the 18th stage on to the last, or 20th, wheel, also the entire casing, were destroyed. A turbine of a type similar to that which was wrecked is shown in figs. 1 and 2.

To get a proper perspective of this accident one should go back a year ago, when, on February 14th, 1917, the 18th diaphragm became distorted; that is, it deflected at its edge in the direction of the 18th wheel, rubbed the buckets where they join the wheel, and stripped the buckets from the 18th and 19th wheels, seriously damaging the 18th and 19th diaphragms. This happened when the machine was being given trial runs. Rubbing began and the throttle was tripped, after which the damage to the buckets and diaphragms followed. When the buckets let go, the speed was below the normal 1,500; perhaps 1,000 or 1,200 R.P.M.—no one knows.

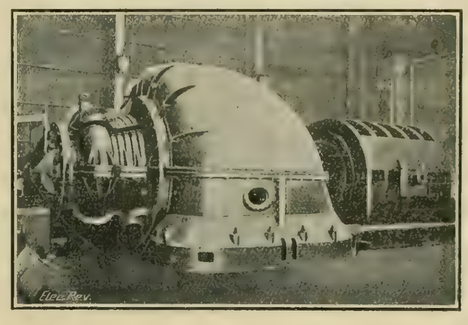

Fig. 1.—Casing of Turbine of Type Similar to that Damaged in Boston.

After the accident of February 14th, 1917, the capacity was reduced to 20,000 KW. from March 17th to May 23rd, while repair parts were being made, by locking closed the secondary valve, which admits steam to the 7th stage. The repair parts in place and the machine in service, annoyance was given because the machine would not carry the load with its swings of 2,500 KW. above the rated 35,000 KW. under the operating conditions. When these swings came, the cycles dropped from the normal 25 to 24. The purchaser was most anxious that the turbine should carry the swings, and it was suggested that 19 1¼-in. holes be drilled in the 8th diaphragm in front of the 8th wheel (see figs. 3 and 4). The holes were drilled to admit high-pressure steam to that stage. The turbine then carried these swings.

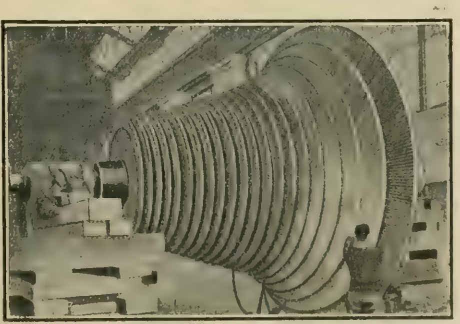

Fig. 2.—Rotor of the Turbine, the Casing of which is shown in Fig. 1.

The machine was designed for 200 lb. gauge pressure at the turbine throttle, 200 deg. F. superheat, and 29 in. vacuum at 30 in. barometer. There was a pressure drop of 4 lb. in the steam line between the boilers and the throttle, or from 200 lb. to 196 lb.; the drop through the governor valves was also slightly more than normal. The builder states that on August 15th last, with 188.7 lb. gauge pressure at the throttle, 132 deg. F. superheat, and 28.7 in. vacuum, the turbine carried 36,500 kw., and that, based on these figures, the capacity would be 39,000 kw. under contract conditions.

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* *Power.* Vol. 47, No. 12. Abstract.

Rumour has had it that thrust-bearing trouble was responsible for the accident of February 14th, 1918. The most authoritative statement claims that what little thrust-bearing trouble did arise did not present itself until after 1917. The trouble was not inherent in the bearing, but was due to oil of poor quality, it having been used for too long a time. After this incident new oil was put in, and the bearing burned out a week later, caused most likely by interference with the oil circulation. Slight changes were made to the circulating system, and the machine was put in service on January 26th, 1918, after which no further trouble was experienced with the bearing. So, evidently the bearing had no influence whatever on the present accident.

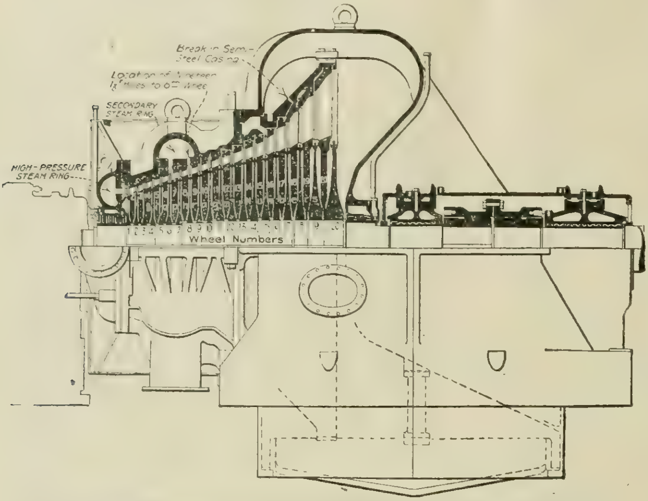


Fig. 3.—Longitudinal Section of 35,000-kw. Turbine Damaged in Boston.

With the foregoing in mind, let us take up the details of the accident. On February 14th, 1918, at 4.55 p.m., when the evening peak load was mounting, the machine was heard to rub, and observed to vibrate. Members of the operating crew climbed on top of the platform to adjust the thrust bearing, hoping to stop the rubbing and consequent vibration. The statements of these men say that the first vibration was heavy, that it was of the nature of a shock, after which there came a second, with such evident commotion within the casing as to cause all hands to seek safety by running to cover.

Six minutes after the first sign of serious rubbing, the damage was completed, and pieces of metal had ceased to fly about. The period during which pieces of the turbine were flying about, and while the low-pressure end of the rotor and casing were going to pieces, was probably not more than 30 seconds.

Going back to the time that the first severe rubbing was heard, at this time the central station of the same company, which is tied in with the O Street station, dropped its load of about 10,000 kw. owing to a station blow-out. Prior to this the machine now damaged was carrying 32,000 kw. This turbine was practically the only unit to take the system's load, and tried to take all the load dropped when the blow-out occurred, by opening wide its secondary valve. The quick opening of this valve so suddenly increased the steam pressure in the low-pressure stages that the impact was probably sufficient either to distort the 18th diaphragm initially and seriously or further to distort it if already deflected, sufficiently to make it further foul the 18th wheel.

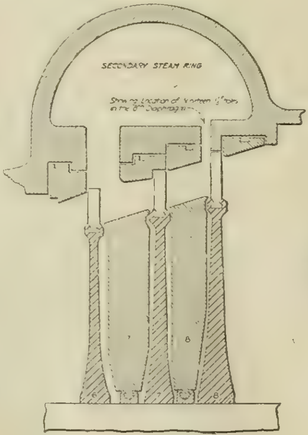


Fig. 4.—Location of Holes in Eighth Diaphragm.

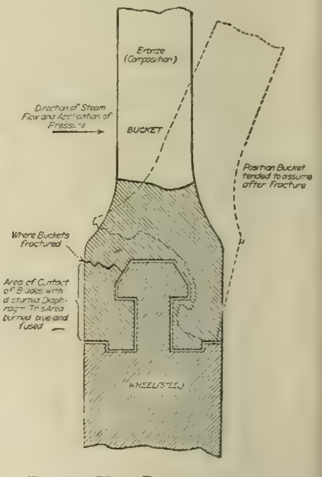

Bronze (Composition)
Direction of Steam Flow and Application of Pressure
BUCKET
Position Bucket tended to assume after Fracture
Where Buckets fractured
Area of Contact of Blades with distorted Diaphragm. This Area burned blue and fused
WHEEL (STEEL)

Fig. 5.—How Buckets on the Eighth Wheel were Broken.

When the secondary valve opened, the machine was said to take on 37,000 kw. Whether it took but 37,000 or, because of the momentum of the rotor, took every kilowatt of that 10,000, no one knows, for it seems there was no instrument to record the load it did take. But it appears certain that the machine took a very heavy load, and took it with the suddenness of a hammer blow. The cycles had dropped from the normal 25 to 24 when the switchboard operator noticed that the turbine was carrying 37,000 kw. Unable to stop the rubbing, the operator on the floor signalled the switchboard man to take off some load, which he did, dropping it to 32,000 kw. It was soon after this that the turbine went to pieces. The buckets on the 18th wheel ripped off, and fouled the 19th diaphragm, which in turn fouled the 19th wheel and the 20th diaphragm.

It is interesting to note that the buckets from the 18th wheel were broken identically as were the buckets from this wheel in the accident of a year ago. In the recent accident the same evidence of heating of the buckets where they join the wheel is apparent as was apparent on the buckets damaged a year ago. Fig. 5 shows where the buckets rubbed, and how they left the wheel. These buckets are indeed tough, as shown in fig. 7. The 20th, and last, wheel has all or nearly all its buckets, though they are severely bent and twisted.

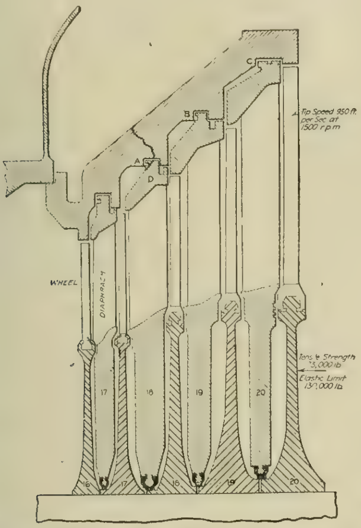
Reference to figs. 3 and 6 shows that a break occurred in the semi-steel frame which holds the diaphragms in the low-pressure end. This conical frame dropped into the condenser, crushing the tubes for a depth of about 2 ft. When this frame broke, it is probable that the 19th and 20th diaphragms let down on the shaft, or, more correctly, on the wheel bases, and either revolved with the shaft, then broke due to centrifugal force, or they were broken at the time their supporting frame cracked by reason of being struck by fragments from other stages. These diaphragms were of cast iron; centrifugal force may have broken them, but at any rate they were broken in many pieces, and were hurled against the outside casing with force enough to blow out the whole end of this casing and break the great web, or bracket, that supports the bearings on the generator side of the turbine. The significant fact is that these diaphragms were the only large pieces of metal to break up completely and leave the turbine.

There are some interesting speculations as to what broke the conical semi-steel casing which held the low-pressure diaphragms, and which enclosed the last five wheels. The designer of the turbine shows by calculations that high-pressure steam at that point, caused by possible closure of the buckets in the 19th diaphragm, could not do it, as the pressure in the ledges A, B, and C, fig. 6, probably was not more than 186 lb. at most. He thinks that the expansion of the 18th diaphragm, caused by the diaphragm rubbing the buckets on the 18th wheel, may have forced the ring D, which is the outside or ring of the 18th diaphragm, to exert pressure enough on the casing to fracture the latter. Others think that it was broken by pieces of diaphragm being jammed against it.

The whole turbine casing is ruined, being severely cracked at the low-pressure end, with other smaller cracks extending to the high-pressure end. As stated, the great bracket, or web, supporting the bearings between the turbine and generator dropped away, letting the bearings free. The low-pressure labyrinth packing was destroyed. There was thrust enough to break the collars at the bearings and to push the exciter, mounted on the end of the mainshaft, forward sufficiently to break the four spider brackets supporting the extreme end of the exciter shaft. The collars on the thrust bearing at the high-pressure end are intact.

All wheels and diaphragms up to and including the 17th stage are intact. The 18th, 19th, and 20th wheels are intact, though their blading is either gone or ruined. There is one small piece out of the rim of the 20th wheel, broken out, presumably, by being struck a tremendous blow by a fragment of diaphragm. Fortunately, the automatic throttle valve which controls steam to the turbine tripped; the men do not remember tripping it, and probably vibration did so, as valves of this design are held open by a catch resting on a steel knife-edge.

That the turbine wheels, especially the 20th, are intact is most gratifying. Nothing could more thoroughly prove the correctness of the designer's calculations and more completely convince one of the adequacy of the factor of safety of these wheels. The 20th wheel has a tensile strength of 13,000 lb., and an elastic limit of 73,000 lb. per sq. in. It is 12 ft. 1 in. diameter, and its tip speed at 1,500 R.P.M. is 950 ft. per second.



A
B
C
D
Tip Speed 950 ft. per Sec at 1500 r.p.m
WHEEL
DIAPHRAGM
Tensile Strength 73,000 lb
Elastic Limit 130,000 lb
17
18
19
20
16
17
18
19
20

Fig. 6.—Section of Last Wheels and Diaphragms, together with Diaphragm Support Frame, which Broke as Shown.

The Boston wheel was certainly subjected to jamming and impact from broken blading and pieces released from diaphragms, and it withstood these severe shocks while subjected to the centrifugal force due to rotation at the normal speed. The machine was carrying 29 in. vacuum at the time the low-pressure end of the casing was blown out. Just what effect the sudden release of the vacuum had one can study out at leisure.

It is probable that steel will be used in the last stages of the Boston turbine when it is repaired. When the machine gets its new casing, the great web supporting the bearings at the generator end will be of steel for the sake of greater safety than cast-iron ensures.

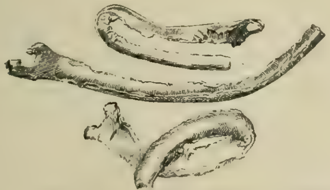


Fig. 7.—Buckets as found after the Accident.

The turbine with its condenser represented an investment of about 335,000 dols.

The details of the accident described, some general observations are in order. It is obvious that cast-iron should not be used where it is likely to be subjected to the stresses imposed by the centrifugal force that a steam-turbine diaphragm would be called upon to resist if it revolved with the shaft. If there are no probabilities of these large diaphragms being let down on the shaft, and if it is found that cast iron for these relatively thin disks is not subject to too great deflection, cast iron seems suitable, as the diaphragms now in use have a high factor of safety against rupture by normal stage pressure.

Since these high-capacity turbines, with their rotations which give wheel-tip speeds of nearly 1,000 ft. per second, have appeared, all have learned that rubbing of a diaphragm on its adjacent wheel and *vice versa* must be immediately stopped to avoid the loss of blading or more serious trouble. The element of time is most vital. In the Boston case, if the throttle had been tripped at the first sign of serious rubbing or vibration, it is probable that the turbine would have needed nothing more than new buckets for the 18th wheel—a delay, of course, but not a delay plus a direct loss of, say, $200,000.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The E.P.E.A. and the C.T.A.A.

With reference to Mr. Thomson's letter in your issue of March 29th, I regret, as the individual responsibie for the report of the meeting of the Council of the E.P.E.A., that my use of the term "application for affiliation" should have caused any dissension.

The following is an excerpt from a letter received some time ago by Mr. W. A. Jones, hon. secretary to the E.P.E.A.: —

"My Association has expressed the desire that their Executive Committee should meet your Committee at an early date, with a view to discussing the question of affiliation.

"(Signed) A. P. MacAlister.
"*Hon. Sec. C.T.A.A.*"

A meeting of the respective Committees was held, and it was decided to refer the matter to the Council of the E.P.E.A. Unfortunately the C.T.A.A. found it impossible to send representatives on the date fixed for this meeting. It was hoped that the report of the discussion and the resolution would have cleared away any doubts and uncertainties, and emphasised the necessity for more cohesion and the inadvisability of raising up barriers of isolation between grades where now, in our Association, no such barriers exist.

Some time ago, in face of the onslaught of the powerful organisation of the rank and file, the E.P.E.A. marshalled the staff engineers of electricity supply undertakings, and received the active support of some chief technical assistants. There were inquiries from others, and, with a view to finding some common basis to incorporate all grades of staff engineers, a meeting of the higher officials, arranged by our Reconstruction Committee, was held at Hammersmith. It was there decided to form a new Association, and a Committee fully representative of all grades of staff engineers from company and municipal undertakings was elected.

The hon. sec., Mr. H. W. Healy, several times summoned the members to meetings, but on each occasion was informed by the C.T.A.A. that their representatives would not attend until such time as the Conference of Company Chiefs and the Associated Municipal Electrical Engineers had decided to send representatives. Efforts were made to this end, but the process was slow, and the Committee appointed at Hammersmith has never yet met. Impeded thus for some time, the Reconstruction Committee of the E.P.E.A. found enthusiasm waning, new Associations springing up in the provinces, and then decided to develop their existing Association on the broad lines of catering for all grades of staff engineers. A national conference was held, the new Associations were amalgamated, and the country was divided into three sections, with centres at London, Birmingham and Manchester. We have at the present time nearly 1,000 members, from chief engineers to junior engineers.

We are keenly desirous of getting the advantage of the support of our London colleagues of the C.T.A.A., but the opinion of the provincial centres and our London Council is that the present system of including all grades of qualified engineers in the membership of the E.P.E.A. is a triumph for the homogeneous, and any step in the direction of the heterogeneous is retrograde, weakening, and undesirable.

The possibility of separating so-called seniors and juniors is beset with difficulties. The position of engineer-in-charge is not now, as in the long ago, a stepping-stone, but a career, and it is incongruous to style our present-day "engineer-in-charge" a junior.

We trust we will hear no more the claims for grade-distinctive societies linked with thin ties of affiliation, but that the best efforts of the existing associations will be bent away from rivalry and towards amalgamating forces with the object, commendable to both and essential to the future well-being of our industry and our country, to improve the efficiency and status of the engineer engaged in electricity supply.

George C. Law.

Electricity Works, Mortlake, *April 2nd*, 1918.

Concert.—The London Station Engineers' Branch of the Electrical Trades Union is holding its first concert at the Horns Hotel, Kennington Park, S.E., on Wednesday, April 24th, at 6.30 p.m.

POPLAR COMMUNAL KITCHEN.

We recently had the pleasure of inspecting the National Kitchen which has been installed at the Bow Baths of the Borough of Poplar by the Borough Council, and which was opened by Lord Rhondda, on March 26th. The kitchen has been in operation for about a month, and is open from 11.30 a.m. to 1.45 p.m., and from 5 to 8 p.m.; over 2,000 portions are served daily, and the public appreciation of its advantages has been manifested by its rapid growth in popularity. Seating accommodation is provided for some 250 persons in a light and airy hall fitted with tables, and nearly 500 persons take their meals on the premises, in two shifts; others bring dishes and take the food home. The tariff is extraordinarily low, the charge for a good three-course meal being 7½d., while a satisfying repast can be had for a few pence.

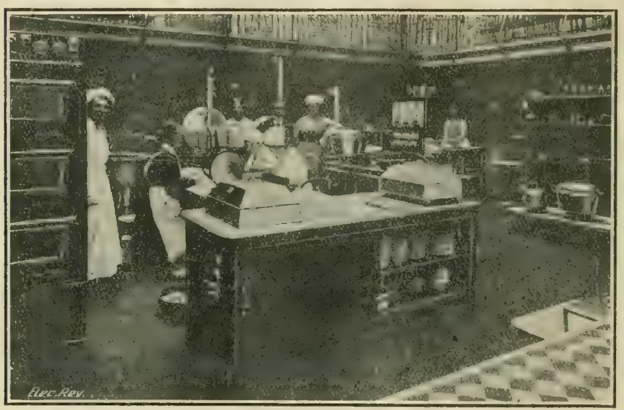


Fig. 1.—"Brompton and Kensington" Cooking Plant at Poplar.

A special feature of the kitchen is the adoption of electric cooking for the major portion of the work. The plant comprises the following items:—

Three-oven electric range, each oven measuring 1 ft. 8 in. × 1 ft. 6 in. × 2 ft., and taking 3 kw. per oven, with three-heat regulation;

Carving table and hot cupboard, 6 ft. 6 in. × 2 ft. 6 in., loaded to 4 kw.;

Three-compartment baking oven, each compartment measuring 4 ft. 5 in. × 2 ft. 5 in., with three-heat regulation;

Two grills, each taking 5·2 kw., in two sections:

Two boiling plates, 1 kw. each, and

Three ditto, 1·4 kw. each, with three-heat regulation,

The above all being supplied by the Brompton and Kensington Accessories Co., Ltd.

One baking oven, measuring 1 ft. 10¼ in. × 1 ft. 9 in. × 2 ft. 8½ in. high, loaded to 6 kw., with 6 heats, supplied by Messrs. Belling and Co.

The remainder of the apparatus includes steam boiling pans and a vegetable steamer, and electrically-driven machines for mincing, peeling potatoes, &c.

The accompanying illustrations show the arrangement of the plant, which is installed behind the service counter at one end of the hall; fig. 1 shows most of the B. and K. apparatus, with the steam cookers in the background, while in fig. 2 the Belling oven is seen at the extreme right hand of the view. The latter is a new pattern which has been standardised expressly for use in communal kitchens; it is built of sheet metal, with angle-iron legs, and is thoroughly lagged all over. Thanks to the lightness of the construction, it quickly heats up without absorbing a great quantity of energy, and the interior, which forms a single compartment is provided with racks accommodating the stock sizes of utensils. The heating elements, 24 in number, are distributed over each side of the oven in two vertical rows; they are rated at 250 watts each. A series-parallel switch controls each side of this oven; with all the elements full on a temperature of 400° F. is attained in 15 minutes. In the middle position of the switch, half the elements are full on, and in the "low" position the two rows of elements are put in series, giving sufficient heat to keep the oven at cooking temperature. As most of the cooking is done with the switches in the "low" position, the life of the elements is very long, and the arrangement described ensures uniform temperature throughout the oven.

The element consists of a strip of mica spirally wound with wire, and attached to "floating" bus-bars, so that expansion and contraction due to changes of temperature set up no strains on any part of the elements. The elements are protected by sheets of perforated steel, and the connections are led away from the bottom ends of the bus-bars through porcelain tubes into a switch-connection chamber. The capacity of the oven is stated to be 100 lb. of beef or seven large pies or puddings, and it weighs 2 cwt.

On the side of the Belling oven is mounted an indicator showing the cost of running it in pence per hour, at 1d. per unit, according to the "heat" which happens to be in use—a striking feature, particularly in view of the fact that this large oven takes only 1½ kw. most of the time.

The plant is supplied with energy from the Poplar Municipal Electricity Works, the load being balanced approximately on the two sides of the three-wire system; energy is supplied at ½d. a unit, plus a small standing charge. The results obtained have been all that could be desired, and the success of the establishment is already assured. We were pleased to learn from two of the Inspectors under the Ministry of Food—Miss Ball and Mr. Johnson—who were present on the occasion of our visit, that, while steam was preferred for boiling on the score of economy, they could not speak too highly of the merits of electric cooking, on account of its cleanliness, convenience, uniformity and other well-known advantages. In particular, they fully endorsed the claim that the electric oven effects a material saving in the case of meat, besides retaining the flavour and succulence of the joint in the highest degree.

We are indebted to Mr. J. Horace Bowden, borough electrical engineer, and to the lady in charge of the kitchen staff, Mrs. Cattermole, for facilities in preparing this article and obtaining photographs of the equipment.

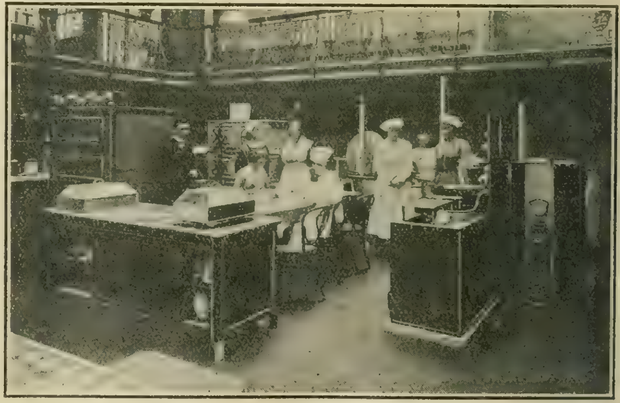


Fig. 2.—B. & K. Apparatus and Belling Oven.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Current-Limiting Reactances.

The accompanying illustration (fig. 1, p. 345) shows three cast-in concrete reactances, each rated at 49 k.v.a., installed on feeders in a generating station by the British Thomson-Houston Co., Ltd., of Rugby. This type of reactance, it is claimed, possesses thorough reliability, great mechanical strength, complete freedom from fire risk, and ready accessibility for inspection. The coil is in the form of a short solenoid with widely spaced turns, the whole being solidly held together by wedge-shaped blocks or pillars of specially cured concrete cast in radial positions around the conductors, and bolted to a heavy concrete base-ring. The lengths of unsupported conductor between pillars are kept well within safe limits. Although concrete cannot be looked upon as a highly insulating material, its use in these coils is rendered thoroughly safe by the thickness used between turns and layers. The layers are not in planes normal to the coil axis, but are wound slightly conically, so that the thickness of concrete increases with the voltage between conductors. This is readily seen in the illustrations, which give the coil the appearance of having layers wound in pairs. The whole coil is supported on stout porcelain insulators having ample leakage distance.

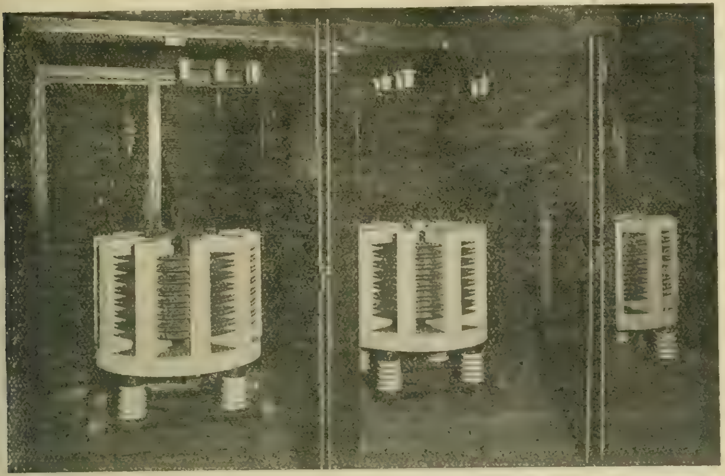


Fig. 1.—B.T.H. Reactances on Feeders.

The use of an air magnetic circuit ensures that the voltage absorbed by the coil is strictly proportional to the current, however large the emergency value of the latter may be. The temperature rise of the copper (at the hottest point) when carrying the normal current of the circuit does not exceed 75° C., which complies with the Engineering Standards Committee Rules for the materials used. In some cases, however, the size of conductor is dictated by the short-circuit current which the coil may have to carry for a given time without reaching a deleterious temperature. This short-circuit current is always assumed to be the maximum possible—*i.e.*, for a three-phase circuit it is equal to the voltage to neutral divided by the reactance in ohms. Owing to good ventilation and open construction, there are no hot spots produced in the winding.

The losses in B.T.H. reactances, due to I^2R in the conductor, are low, averaging in KW. about 4 per cent. on 50 cycles and 7 per cent. on 25 cycles of the rated K.V.A. capacity of the reactance. The K.V.A. capacity is taken as equal to (normal current)^2 × reactance in ohms ÷ 1,000.

Provided the reactances are installed at a distance from ironwork equal to their radius, no perceptible stray-field effects are produced. With full-load current in the coil, a modern shielded instrument may be brought quite close without its indications being affected more than 2 per cent.

Magnifying Scale Deflections.

A simple means of increasing the deflections of an electrometer is often wanted under circumstances where the use of a sufficiently long distance from mirror to scale is inconvenient. This may be accomplished by interposing a concave lens between mirror and scale, thus magnifying the deflection. A lens of rather long focus placed, if anything, nearer the mirror (fig. 2) is preferable, as the effects of chromatic aberration are thereby diminished and the proportionality of the deflections is also better preserved. The image will be much brighter if a cylindrical lens is used.

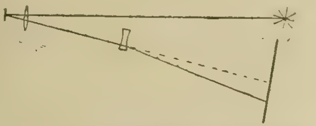


Fig. 2.—Device for Magnifying Deflections.

By this means a Dolezalek electrometer with platinum fibre was raised from 3.000 to 18.000 mm. per volt at a scale distance of 4 m. Owing to diffraction, the spot was about 1 mm. wide, but its position could be read to 0·2 mm., and the proportionality between deflection and potential was very good.—E. H. Kennard, in *Science*.

A Simple Carbon Terminal.

In view of the difficulty now experienced in obtaining the ordinary brass screw terminals for the carbons of primary cells, an ingenious substitute devised by The British Utilities, Ltd., of 148, South Park Road, Wimbledon, S.W. 19 for their "Bul" cells will be of interest. It consists, as shown in fig. 3, simply in drilling a hole in the end of the carbon rod and bushing it with an ordinary shoemaker's eyelet on each side, the two eyelets telescoping one within the other. This makes an effective metallic connection with the carbon, to which a lead can be soldered, and it has the advantage that the makers can supply the rods thus eyeleted to customers who are unable to furnish priority certificates.

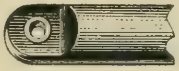


Fig. 3.—Eyeleted Carbon Rod.

LEGAL.

County of London Electric Supply Co., Ltd., *v.* James.

In the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., plaintiffs sought to enforce payment of £1 10s. 2d. for electrical energy supplied.

Defendant said he really did not owe the money. The dispute arose out of the plaintiffs charging him for brushes. A motor was of no use without brushes. He was willing to pay if he should. He had had brushes from the plaintiffs to run his motor for 12 years, and only during the last 12 months had they sent him an invoice for accessories. It was not a matter of money but a matter of principle.

Judge Atherley-Jones said that was not the occasion on which to raise the question. Defendant had allowed judgment to be given against him.

Plaintiffs' representative said that the claim was made strictly in accordance with the agreement which the defendant had signed, under which the current was supplied to him.

Defendant added that the plaintiffs supplied him with a brush a month ago, and he received an invoice for two. He thought they were supplied under the hiring agreement, and that no charge ought to be made for them.

Judge Atherley Jones said that any *bona fide* defence which the defendant had he could have raised at the trial. He must order payment of the money in a month.

Hogan & Wardrop *v.* J. R. Offer & Sons.

In the City of London Court, on April 9th, before his Honour Judge Atherley-Jones, K.C., plaintiffs, electrical suppliers, 2, Gresham Buildings, E.C., sued defendants, engineers, of Kingston-on-Thames, for £11 8s. for two electric fans supplied for ventilating purposes.

Mr. Carnegie, for the plaintiffs, said that the fans were ordered in June of last year. Defendants now said they were unsuitable for the purpose for which they were supplied. They complained about the fans, and plaintiffs said they would be quite willing to put right anything that was wrong.

Mr. Sherwood, for the defendants, said that they had been put to great trouble and annoyance because their customers complained.

Mr. Carnegie said that the plaintiffs' view was that the defendants had accepted the fans.

Mr. Sherwood replied that the blades were not balanced, the fans were always stopping, and they required rebushing.

Major Hogan, one of the plaintiffs, said that the defendants had refused to return the fans, and that had led to all the trouble.

Mr. Carnegie said the plaintiffs were relying on the fact that the defendants had been very unreasonable in regard to the time within which they made complaint.

The Major said that the fans were quite satisfactory before they went out. The motor had had an exhaustive test. If electric fans were not properly used they would easily get out of order.

In cross-examination, he said that the periodicity for Kingston was 77, and the fans were set accordingly. If the periodicity was wrong the fans would never have worked at all. The pressure was 105 volts. He had never heard that the fans would only run at half speed. Any electrician's mate could have told at the outset whether the fans were wound to the correct periodicity. He assumed that a customer like the defendants knew what the periodicity of Kingston was, and then it was not the plaintiffs' duty to inquire at the Town Hall. They were given the details on which to work. He did not know that within three weeks of starting the bearings were badly worn. There was no limit theoretically to the life of an electric fan. It was a well-known principle of the electrical trade that if a fan was unsatisfactory, it should be returned at once. That was not done.

Henry Harding, electrical engineer to the defendants, said that the fans, which were 12-in. box ones, were unsatisfactory from the first. After he connected the fans they would not start without a push off, and they never ran at more than half speed. The blades were out of true, and that knocked the bearings out in a very short time. The fans ought to be wound for the periodicity of the district. The fans were wound for 50 instead of 77 periods. The brass was very soft metal. His customer would not allow him to take the fans out. In fact, they ordered him out of the premises, so displeased were they.

Judge Atherley-Jones did not doubt the *bona fides* of the defendants, but there was a golden rule in commerce that when there was any defect in an article complaint should be made at once, and that was not done. Judgment for the plaintiffs, with costs.

WAR ITEMS.

Restrictions Relating to Electric Converter Plant.—The Minister of Munitions has issued under date April 5th a "Converter Plant Control Order, 1918," which reads as follows:—

"1. No person shall on or after the date hereof until further notice purchase or manufacture, or erect or install in or in connection with any factory, workshop, steel works, shipyard, colliery, or other premises for the purposes of which alternating current is or can be made available, any rotary converter plant, motor generator plant or converter plant of any description for transforming alternating current to direct current, or any part of such plant (all or any of which shall be included in the expression 'converter plant') except under and in accordance with the terms of a licence issued on behalf of the Minister of Munitions by the Director of Electric Power Supply.

"2. Nothing herein contained shall prevent the carrying out of any necessary repair to converter plant already installed at the date hereof, or the purchase, manufacture, erection, or installation of converter plant required solely for electrochemical of electrolytic processes or electric traction.

"3. All applications in connection with this Order shall be made to the Director of Electric Power Supply, Ministry of Munitions, 8, Northumberland Avenue, W.C. 2.

"Note.—The licence required by this Order is in addition to and not in lieu of the usual Priority Certificates and permit reference number

"Applicants for licences are warned against purchasing or installing direct-current motors before the licence for the necessary converter plant has been obtained."

Trading with the Enemy.—The "London Gazette" for April 5th contains names of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Uruguay, Bolivia, Chile, Honduras, Mexico, Morocco, Netherlands, Netherlands East Indies, Salvador, Spain, Sweden, and Venezuela.

Electricity Supply from Public Mains.—In future, all applications to the Ministry of Munitions for Priority Certificates to enable motors and other electrical plant (requiring a supply of current from the public mains) to be purchased should be accompanied by a certificate from the chief engineer or manager of the public service undertaking concerned stating:—

1. That adequate generating plant capacity is or is not available.

2. That no additional cost or material is involved in connecting the premises to the mains (including sub-station equipment, if any), or

3. Where expense is involved, the material and apparatus to be provided and the cost thereof, and whether lead-covered cable is necessary or not. Where lead-covered cable is deemed necessary, the voltage of the current transmitted should be stated.

Applicants should, whenever possible, also obtain the written support of the Government Department interested in their manufactures, and forward a copy of same.

The purpose of the above procedure is to reduce the demand for current—other than that used for urgent war purposes—supplied by the public service undertakings, and the time occupied in making inquiries.

Labour in Germany After the War.—As we have found in the United Kingdom, so in Germany, the consequences to the nation of friction between employers and employed have been brought into bolder relief during the war. No belligerent Power has been without its labour troubles. Economic reconstruction after the war, it is now held, postulates the solution of the labour problem. This is appreciated in Germany as profoundly as in the United Kingdom. The German Trade Unions have put forward a claim to have a voice in Reconstruction questions, and have submitted to the Reichstag a complete scheme embodying their recommendations for the transition period and after the war generally. More recently they have been concerned in placing a Bill before the Bundesrat for the establishment of Chambers of Labour, with conciliation committees and arbitration courts composed of employers and employés, much on the lines recommended for the United Kingdom in the now celebrated Whitley Report.

Discussing the tasks of the German Trade Unions in the economic struggle of the coming peace-period, Herr August Winnig, a well-known trade union leader, states that their attention should be turned to the question of the profitable production of German goods, not less than to the problem of wages. The revival of keen international competition will, in his opinion, bring German industries face to face with great difficulties, which can only be surmounted by the adoption of more scientific methods of production. He adds:—

> Trade Unions have hitherto viewed such efforts with considerable suspicion as tending to exploit labour more than ever; but if the sound underlying principle of utilising more completely the total energy spent on labour is once grasped, no objection can be brought against the suggestion from the point of view of labour. The thought that labour, not merely as a wage-earning body, but as an indispensable part of the whole machinery of production, is as much interested in the prosperity of industrial undertakings as the owners, and ultimately the German nation, is now frequently expressed in trade union and socialistic organs.—*Board of Trade Journal.*

Exemptions Withdrawn.—An Order has been issued by the Minister of National Service withdrawing exemptions from military service held wholly or partly on occupational grounds by certain men of various ages employed in a large number of occupations, who are in medical categories A, B 1, and C 1, or medical grades 1 and 2, or who have not been medically examined.

The Order, which is far-reaching in its effect, provides that the exemptions of the men concerned are withdrawn as from 24th inst., after which date the men will be called up for military service. The current regulations provide that applications for renewal of exemptions withdrawn by the Order (which can be made on authorised personal grounds only) may be lodged within seven days of withdrawal—that is, in this case by May 1st. A de-certified man has no right to apply for renewal of exemption on occupational grounds, nor has his employer any right to make such an application on his behalf. A limited discretion has been given to each Director of National Service, in the regions into which Great Britain is divided, to suspend the calling up of a de-certified man who is employed on Government contract for urgent war supplies. Applications for this suspension must be made before April 24th in a special form, and suspension will only be granted under exceptional conditions.

Exemption Applications.—Mr. Hayes Fisher, President of the Local Government Board, has addressed a circular letter to local tribunals stating that the Minister of National Service has directed the local National Service Representatives to apply, except as regards certain cases which have been before tribunals within the last month, for the review of exemptions held on occupational grounds by men in Grades 1 and 2, or in categories A, B 1, and C 1, or who have not been medically examined. He impresses upon tribunals the necessity in the present crisis of the extreme urgency of promptly dealing with all these cases, and with any others which may come before them, particularly as regards men in the grades referred to, and asks that, where possible, such cases will be disposed of within the next fortnight.

Cambridge Tribunal has granted three months' exemption to A. E. Everitt (32), electrical engineer.

At Dover, on a review, four months, unless substituted, were granted to W. J. Revell (26, B 2) and W. C. Piddock, drivers of electric scavenging vehicles. Four months were also conceded to G. F. Howard (35, C 1), assistant fitter on the Corporation tramways.

Torquay Tribunal has decided that if the men are classified in Grade 1 or 2, W. Hannaford, driver, and E. J. Rawlings, traffic inspector, engaged with the Tramway Co., shall be available for the Army.

The Epsom Rural Tribunal has granted three months' exemption to Mr. W. J. Webb, electrician, of Bookham Lodge, Cobham.

At Hastings, the manager of the tramways, Mr. H. Vincent Edwards, appeared in reference to the review of the cases of six Grade 1 men, four in Grade 2, and eight in Grade 3, and one rejected. Mr. Lloyd, for the Military, asked whether some arrangement could be come to whereby Grade 3 exemptions were assented to if Mr. Edwards released the others, some at a time, so that there should be a minimum of inconvenience. Mr. Edwards said that he could not assent to it with regard to two men. One, Webb, the engineer, was the only man with any electrical training, with the exception of himself, on the whole job, and if the system was to be run it was imperative that they must have somebody who was skilled. The other man was a turner who had been trained to do the work because there was nobody else. The Tribunal granted six months to a linesman, Webb, and the turner, the other Grade 1 and 2 men were exempted for one to two months each, and the Grade 3 men for six months.

STEAM CONDENSATION.

By A. ARNOLD.

The increasing size of units employed in central-station practice has resulted in something approaching standardisation of condensing arrangements, and has brought to the fore a mass of data and experience. It has also caused a healthy realisation of the effects of operating plant under different vacua, because this is so easily demonstrated by the indications of the many measuring instruments which can be, and are, justifiably employed upon big units. But it is nevertheless a fact that many otherwise well-informed technical men are regrettably vague in their ideas regarding condensation, as such, although perfectly familiar with the operation of the plant. The notion is very prevalent that there is something mysterious, or, at any rate, theoretically abstruse, in the process; it is the purpose of this article to show that this is not so, and that in fact nothing more is required for a complete practical understanding of the matter than an elementary knowledge of physics and engineering common-sense.

After all has been said, condensation of steam is merely the change of state of a fluid—water—from a gas or vapour to a liquid; were it not for quite extraneous and incidental complications, this change would be so simple that it would call for no comment. It would merely involve provision for the removal of the latent heat of the gas, and if it were a practical matter would require considerably less cooling surface and less pumping plant than has, unfortunately, to be actually provided. Water, the working fluid universally utilised for large-scale heat cycles, has a latent heat which increases as the pressure decreases, and, like every other fluid when in a gaseous form, has a definite temperature corresponding to any given pressure, and *vice versâ.* At 29 in. vacuum its temperature is about 79° F. and its latent heat 1,060 B.TH.U. per lb. Considering that this heat must be absorbed at a temperature not higher than 79° F. in order that the change of state may take place at all, it follows that considerable apparatus would be necessary even in this simple case. A great many heat units are unavoidably wasted in heating up the circulating water, and these low-grade units cannot, in the present state of our knowledge, be efficiently utilised. The fact that steam liquefies at reasonably low temperatures only at such low pressures is not exactly ideal for heat-engine purposes, unless, indeed, some new type of plant can be evolved wherein the latent heat released by the change of state is turned to account; according to present experience, a working fluid which liquefied at or about atmospheric pressure and at a low temperature would be preferable. Unfortunately, we do not know of such a fluid which could be practically utilised.

The idea is common that the lower the pressure at which an engine exhausts the better; sight is lost of the fact that we are dealing with heat engines, and the desirable low pressure is, therefore, quite an incidental item, corresponding as it does with the lower practical limit of temperature possible with water as the working fluid; in other words, it is the low temperature that is desirable, not necessarily a very low pressure of exhaust. In practice, this low pressure (or "vacuum") gives rise to considerable complications. The exhaust steam, now water, must be pumped up to atmospheric pressure or more before it can be available for further use, and a portion of the engine, and, in some cases, considerable piping is under a greater external than internal pressure, so that any small leakage means the entry of air into the system instead of merely a small escape of steam. It is this leakage air, in addition to a certain amount which may separate out in the process of boiling, which necessitates the provision of compressors to bring it up to atmospheric pressure; this is the function and the justification of the existence of what are termed "air-pumps."

Everyone who has had any training in elementary physics, and however long ago that training was, will remember that Dalton's Law deals with the case of mixed gases, with regard to vapour pressure. Each gas, as mentioned previously, has its own particular pressure at any given temperature, and if two be mixed the resultant pressure will be the sum of these "partial" pressures at that temperature. In this case of air and steam, therefore, we may say that at a given temperature the pressure existing in an apparatus such as a condenser will be equal to the pressure due, first, to the air, as if it occupied the volume alone at that temperature, added to the pressure due to the vapour of water at that temperature, just as if it, too, were alone. Now, in the simple case in which there was no air, we merely had to maintain a temperature corresponding to the vapour pressure of water at the "vacuum" desired (*e.g.*, 79° F. at 29 in.); but if there were air present there would be a pressure in excess of 29 in. vacuum at 79° F. due to it; otherwise the whole pressure existing would have been accounted for by the vapour, and the air must be at zero pressure, and hence it would have an infinite volume (for $p v = c$, according to Boyle's Law), which is hardly within practical politics from the point of view of a compressor or air pump to deal with it. To preserve our 29-in. vacuum we must, therefore, maintain a lower temperature than 79° F. if there be air present, as is inevitable in practice, and the size of the compressors necessary for returning this air to the atmosphere will depend both upon the weight of air entrapped and its initial volume—*i.e.*, upon the vacuum carried. An ordinary air pump, or, more correctly, a low-pressure compressor, will deal practically with a given volume of vapour, whatever its pressure, within limits, of course; so that if at any time the amount of air entering a vacuum system exceeds that which the air pump is delivering at atmospheric pressure, the internal pressure will rise (*i.e.*, the vacuum will fall), until it is such that the volume of the air is decreased to the capacity of the air-pump. To compensate for small air leakages, therefore, the air-pumps may be speeded up, if they be of the reciprocating type, thereby increasing their effective capacity.

In practice, of course, the temperature of a condenser is not maintained uniform at all parts—the process is gradual. The cold surface provided is much less efficient as a medium for cooling air than for condensing steam, and itself varies in temperature in different parts. Normally the hottest circulating water should be adjacent to the entering steam, and here the temperature of the mixed steam and air will be exceedingly close to the theoretical figure for steam alone at that vapour pressure, for the volume of the air will be negligible compared with that of the steam. This fact is useful, as a standard thermometer close to the vacuum gauge pipe on the turbine exhaust will serve as a most reliable check upon that gauge's indications, by means of the ordinary steam tables. A large amount of heat is transferred to the circulating water from the steam as the latter passes the first few rows of tubes, and a corresponding and definite amount of steam is condensed into water. In an ideal condenser this water would pass directly to the "wet"-pump suction, at its highest temperature, but in most practical designs it has to trickle over more or less numerous other tubes, being needlessly cooled, and screening a certain amount of surface from direct contact with the steam and air; on the other hand, it will receive heat from other of the vapour which it may condense. As water is formed, the volume of the air becomes more comparable with the remaining steam, until at the bottom of the condenser the air occupies the whole space, all the steam having been condensed and preferably drained away. Hence the volume of the air per unit of weight will depend upon the coldest temperature of the circulating water, and the temperature of the condensed water will be as high as possible. Since the air must be removed by mechanical means, it must needs have a finite volume and pressure, and for this reason, if for no other, it is impossible to obtain a vacuum equal to the barometer.

The percentages known as "Vacuum" and "Condenser" Efficiency respectively are very useful guides when investigating the cause of a slowly developing drop in vacuum attained under working conditions, but, as conventionally expressed, they must be interpreted together in the light of previous results, and intelligently, for it is not impossible to obtain figures exceeding 100 per cent.; the ratios are, to an extent, arbitrary and empirical, but will be found useful, nevertheless. "Vacuum" efficiency is expressed by the ratio of observed vacuum (by mercury column) multiplied by 100 and divided by (the barometric height minus the vapour pressure corresponding to the temperature of the air-pump suction,) and any falling-off in this figure indicates that the plant cannot cope with the amount of air to be compressed; in other words, that an air leakage is occurring. "Condenser" efficiency is taken as the observed vacuum multiplied by 100 and divided by (the barometric pressure minus the vapour pressure corresponding to the temperature of the outlet circulating water); its gradual deterioration would indicate one of two things. The condenser tubes may be becoming scaled up or blocked up by dirt, or the circulating pump may be failing to deliver the correct quantity of water. A rise in the friction head lost by the circulating water across the condenser will indicate the former, a fall the latter; but more often a combination of these causes reacts to give higher circulating outlet temperatures.

It may be noticed in the foregoing that it has been taken for granted that separate pumps are provided for dealing respectively with the condensate and the air. This is now standard practice in one form or another for most sets over 2,000 KW. capacity, and certainly for all big sets, *i.e.*, over, say, 6,000 KW.—although, by the way, our American Allies would probably multiply that figure by a constant of about 4 or 5 before considering the adjective justified! In a number of special types of air pumps steam jets are used, and in many cases pumps are turbine driven and the auxiliary exhaust is used for heating feed water or make-up; this steam is generally used by direct contact, and is thereby itself condensed, and in practice it is often difficult to prevent such heaters from knocking or hammering. The secret lies in designing the heater with a suitable steam velocity, sub-dividing the orifices by which the steam issues in such a manner that all the steam is immediately in contact with an adequate amount of water, and making provision for a sufficient circulation of the whole of the water to be heated. Where steam jets are employed as air pumps, and the steam is subsequently condensed, it is imperative that the resulting water be given the opportunity to become de-aerated before being used as boiler feed, or corrosion will result; it should also be heated, preferably by direct contact with exhaust steam at atmospheric pressure or less.

Rotary air pumps are now used very generally, and, provided they have an adequate margin and can quickly remove the dense air when starting, are very satisfactory. It is possible with this type of plant, working well below capacity, to obtain vacua apparently greater than that theoretically possible at 100 per cent. efficiency, that is having regard to the temperature of the water in use in the pump. The explanation is that evaporation from the surface film of this water so cools that film that the pump operates as if supplied with water at the lower temperature, the velocity of the water being too great for conduction appreciably to affect the process.

BUSINESS NOTES.

Book Notices.—"Circular of the Bureau of Standards." No. 67. "Combined Table of Sizes in the Principal Wire Gauges." The table combines in one series the sizes in the American (B. & S.). steel, Birmingham (Stubs's), British standard, and metric wire gauges, arranged in order of diameters of wires. It gives the diameters of all the gauge numbers in these five systems in mils, inches, and millimetres, also the cross sections in square mils. circular mils, square inches, and square millimetres. The table is specially useful to manufacturers who wish to determine the nearest equivalent in American or British gauge sizes of wires. Washington: Government Printing Office. Price 5 cents.

"The Just Claims of Italy: the Question of the Trentino, of Trieste, and of the Adriatic." By Whitney Warren. Price 50 cents.

"Essentials of Electrical Engineering." By J. F. Wilson. London: Constable & Co. Price 10s. 6d. net.

"*Proceedings* of the Physical Society of London." Vol. XXX, Part 2. February 15th, 1918. London: Fleetway Press, Ltd. Price 4s. net.

U.S. Lead.—By agreement with the lead industry, the United States Government will be furnished with from 6,000,000 to 12,000,000 tons of lead per month, at prices averaging 7c. (3½d.) per lb.—*Times.*

Dissolutions and Liquidations.—CLARKE, FORDE, TAYLOR & ERSKINE-MURRAY, civil and electrical engineers, 4, Great Winchester Street, E.C. Messrs. J. A. L. Dearlove and J. Erskine-Murray have dissolved partnership. Mr. Dearlove will continue the business under the former style of Clark, Forde and Taylor. Mention of this matter is made in our "Personal Column" to-day.

STANDARD CABLE MANUFACTURING CO., LTD.—A petition presented by the Board of Trade in the matter of the Trading with the Enemy Amendment Act, for the winding-up of this company, is to be heard on April 16th.

ELECTRIC UTILITY CO., LTD.—A meeting is called for May 23rd at 50-51, High Holborn, W.C., to hear an account of the winding up from the liquidator, Mr. A. Jonckheere.

Catalogues and Lists.—MESSRS. JAMES W. CARR AND CO., 35, Queen Victoria Street, London, E.C. 4.—Thirty-six-page brochure giving descriptive notes, with illustrations and prices, of various accessories for the machine shop.

MESSRS. COLE, MARCHENT & MORLEY, Prospect Foundry, Bradford.—Catalogue No. 53 (24 pages) containing a full description, with half-tone illustrations, of the Morley-Güldner slow-speed vertical four-cycle constant-pressure oil engines.

THE POWER PLANT CO., LTD., West Drayton.—Twelve-page pamphlet (No. 11) containing a description of their double reduction marine turbine gears.

Trade Announcements.—MESSRS. NAPIER-KIMBER, LTD., notify that their head offices and wholesale electrical supplies department are now at 109, Great Portland Street, London, W. 1. Telephone No.: Mayfair 3860. Telegrams: Aperimber, 'Phone, London.

MESSRS. CECIL HODGES & CO., LTD., state that as the War Committee require their premises (Balfour House, Finsbury Pavement, E.C.), where they have been for the last 15 years, for the purpose of a Government Department, they have removed to Empire Works, Dalston Lane, London, E. 8. Telephone No.: Dalston 2464. Telegrams: "Ammeter, London."

MESSRS. FERGUSON, PAILIN & CO., LTD., electrical and general engineers, Openshaw, Manchester, have opened an office at 37, Norfolk Street, Strand, W.C. Telephone No.: City 547.

LIGHTING AND POWER NOTES.

Armagh.—The Urban Council has referred to Committee an application by the Gas Light Co. for permission to use the streets to enable them to install electric lighting.

Australia.—The Sydney (N.S.W.) city electrical engineer reported that, as a result of the recent strike, the working of the electricity undertaking for the month of September last showed a loss of £11,991, as against a profit of £1,588 in August. In October there was a slight profit—viz., £75. A contributory cause was that the charges for coal cartage increased the price of coal at the furnaces from 15s. 7d. to 24s. 4d. per ton.

The purchase of a colliery by the Sydney City Council, so as to secure a permanent supply of coal for the power house, has recently been under discussion by the Council. It was stated that the advisers had recommended the purchase of the Balmain Colliery on account of its nearness to the generating station; the vendors had asked £100,000, and it was estimated that the cost of necessary alterations would be about £65,000. If the City Council acquired the colliery the output was estimated to be 1,000 tons a day, at a cost of 10s. 9d. per ton.

The work of cutting a tunnel under Sydney Harbour from Long Nose Point to Greenwich Point for the purpose of carrying the cables to supply electricity to the North Shore has had to be abandoned, so far as the original line is concerned. The failure is due to a narrow fissure in the rock bed about 200 ft. below the water level; the tunnel works had reached the deepest point, and were nearly halfway across, when an inrush of water took place, which all efforts have failed to clear. A fresh start has now been made, a slight deviation being made from the old working. The new tunnel will follow practically the same line as the former one, but will go fully 30 ft. deeper at the point where the inrush of water occurred.

The Under-Secretary to the Local Government Department has advised the Newcastle (N.S.W.) Municipal Council that the Council's borrowing powers are not limited to £160,000, including electricity supply, under the Local Government Act; the Council is empowered to carry on the electricity undertaking not only under the Local Government Act, but also under the City of Newcastle Electric Lighting Act. The only restriction is that the Government's approval has to be obtained before borrowing.

Respecting the proposal to establish some central authority to take over electric power production, the Minister says that, in his view, the proper authority to be created for this purpose is a Greater Newcastle Council, and he hopes, as soon as Parliament has dealt with the Greater Sydney Bill, to introduce a similar measure for the City of Newcastle and suburbs. As it will not be possible either to finance or to obtain machinery during the war for any large electricity supply scheme, the Minister fully expects to be able to secure the passage of a Greater Newcastle Bill in time to allow the Council to embark on a large scheme of power supply.—*Sydney Daily Telegraph.*

The Minister for Public Works (Victoria) has submitted to the Executive Council for approval an Order to enable the Melbourne

Electric Supply Co., Ltd., to supply electricity in the Black Rock district of the Borough of Sandringham. The maximum prices which may be charged per quarter under the Order are :—Up to 20 units, 15s. ; for each unit over, 9d. per unit.

Aylesbury.—PLANT EXTENSION.—An official inspection took place on Thursday, April 4th, of new plant recently installed at the borough electricity works. This undertaking was started after the war commenced, and it has already been found necessary to extend the plant. In the new plant a conversion from Diesel to gas engines has been made, resulting in a considerable reduction of the fuel bill. A description of the new plant will appear in our next issue.

Belfast.—L.G.B. INQUIRY.—A L.G.B. inquiry was held by Mr. P. C. Cowan, Chief Engineering Inspector, on Thursday, April 4th, into the Corporation's application for sanction to a loan for £310,750 for extensions to the city electrical undertaking.

Bradford.—LOAN APPLICATION.—The Electricity Committee recommends the City Council to make application to the L.G.B. for sanction to borrow £152,651 for the provision of a new 15,000-KW. turbo-generator, with condensing plant, auxiliaries and coal conveyor.

Bridlington.—PRICE INCREASE.—The T.C. has revised the tariff for energy as under from the March meter readings :—General lighting, up to 500 units per quarter, 6½d. per unit ; over 500 and up to 1,000, 6d. ; over 1,000 and up to 1,500, 5½d. ; beyond, 5d. Heating and cooking, up to 1,000 units per quarter, 2½d. ; beyond, 2d. Power, up to 250 units per quarter, 2½d. ; beyond, 2d.

Canada.—The *Electrical World* states that the London Electric Co., Ltd., a corporation controlled by Mackenzie & Mann, was to terminate its business in London, Ont., about March 15th, and its plant would be dismantled and scrapped. The company formerly sold power to customers taking approximately 2,500 H.P. at 9 cents per KW.-hour net, plus meter rates. When the Hydro-Electric Commission entered the field, it charged 4·5 cents per KW.-hour, and gradually reduced charges to 1·5 cents per KW.-hour, and the London Electric Co. was unable to compete. When the private company was unable to obtain coal for its plant during the recent shortage, the directors decided to suspend operation. It is reported that the Ontario Government has ordered Mackenzie & Mann to turn over two of the generating machines at Niagara Falls, Ont., to the Hydro-Electric Commission.

Continental.—ITALY.—WATER-POWER UTILISATION.—According to a recent return, 54 concessions to establish plants to utilise water power in Italy to the extent of 208,036 H.P. were granted last year. The Province of Piedmont heads the list with 62,352 H.P., Lombardy being second with 37,106 H.P., and Umbria third with 34,519 H.P.

Dartford.—The West Kent Electric Co., Ltd., has informed the U.D.C. that it will pay as from October 1st, 1917, the higher price asked by the Council in respect of energy taken in bulk over 600 KW. and the equivalent number of units. The supply in excess of 600 KW. will, therefore, be continued.

Derby.—LOAN SANCTION.—The L.G.B. has sanctioned the following expenditure in connection with the extension scheme of the Corporation electricity undertaking :—Conveyors, £880 ; siding, £220 ; land for coal siding, £400 ; turbo-generator, &c., £40,500 ; and mains extension, £9,000.

Hull.—LOAN REFUSAL.—The L.G.B. has declined to sanction the borrowing of £19,221 for the installation of two boilers at the electricity works.

Lancashire Linking-up Scheme.—The boroughs in Group D of Lancashire electricity undertakings—Accrington, Bacup, Blackburn, Burnley, Colne, Darwen, Haslingden, Nelson, and Rawtenstall—have appointed a Sub-Committee, consisting of a representative of each, with the electrical engineers, to prepare a report as to the cost of interconnecting the undertakings included in the group, and also the advantages expressed in terms of money which may be expected to accrue from such interconnection.

London.—L.C.C. AND LINKING-UP.—In a letter to the Borough Councils of Hackney, Poplar, Shoreditch and Stepney, the L.C.C. states that its Finance Committee has had under consideration, in connection with the large loan applications which have been received, the general question of extensions of the electricity undertakings of the Hackney B.C. and of those B.C.'s which are linked up with it, and draws attention to the desirability, from the financial point of view, of effecting the largest possible measure of co-operation between the electricity undertakings, in order to avoid unnecessary extensions involving capital expenditure, and recommends that, before any new proposals for extensions are put forward by any one of them, the question of avoiding such extension by co-operation shall be considered.

HACKNEY.—FUEL ECONOMY.—The Baths Committee has had under consideration the transfer of the whole of the lighting of the baths premises to the mains of the electricity undertaking, as a means of saving expenditure, especially in the consumption of coal. The Electricity Committee has offered to supply the necessary energy, and the small amount required for power in the laundry, at the rate of £1 per KW. per quarter, and ½d. per unit, plus the war advance, conditionally upon the laundry engine being replaced by an electric motor. The Committee has accepted the offer.

Morocco.—The Acting British Consul reports that rapid progress in the installation necessary for the electric lighting of the town of Fez is being made by the concessionaire company. The agreement was made in July, 1914, but, owing to the war, the work was only begun recently on the conclusion of a supplementary convention recognising the increased cost of installation, and making certain more favourable conditions. The engineer in charge of the canalisation of the water power states that it is hoped to obtain electrical plant sufficient to produce 3,000 H.P., and to have it working by next January. The concession also comprises the exploitation of a second group of waterfalls in the neighbourhood, those of the Oued Bou Kherareb, which it is hoped to harness after the war. The power from these falls will be supplied to factories in Fez, and, probably, at Mequinez, 40 miles away.—*Board of Trade Journal.*

Newcastle-under-Lyme.—LOAN SANCTION.—At a meeting of the T.C., it was reported that the L.G.B. had sanctioned the borrowing of £3,000 for the purpose of linking-up the borough electricity undertaking with that of the Stoke-on-Trent Corporation. The Electricity Committee reported that it had received a letter from the Ministry of Munitions urging that electricity works should install Diesel engines, in order to adopt the use of tar oil in the place of imported fuel oil. The recommendation of the Committee that the electrical engineer be instructed to obtain information from works using tar oil and report, was approved.

Pontypool.—The Council of the U.D.C. has resolved, subject to the consent of the L.G.B., to proceed with the purchase of the undertaking of the Pontypool Electric Light and Power Co.

Rochdale.—REVISION OF PRICES.—The T.C., last week, considered a letter from the Ministry of Munitions recognising the reasonableness of an advance on the pre-war price of electricity supplied under long contracts for controlled undertakings, and suggesting that uncontrolled establishments should voluntarily comply with a revision of their prices in the exceptional circumstances. If an increased price could not be obtained by consent proceedings could be taken under the Courts Emergency Powers Act. The Electricity Committee has decided to approach long-contract consumers on the matter, but that the revision of charges to general consumers be deferred until the result of last year's working is known.

Salford.—LOAN APPLICATION.—The T.C. has decided to apply for sanction to borrow £15,000 for the scheme for bulk electricity supply from Manchester.

Tasmania.—The Minister of Mines recently received a deputation of Zeehan residents asking that the King River power scheme should be expedited in order to give cheap power to the Mount Read and Rosebery Mines, Ltd., and, further, that the Government should give every consideration to the company respecting the sale of the Tasmanian Smelting Co.'s plant and assets, which had now become the property of the State. The Minister, in reply, said he did not anticipate any difficulty in financing the King River power scheme, which would cost about £1,000,000 ; the scheme would be pushed ahead, but a good deal of time would be absorbed in collecting data. The Government would have to sell the whole of the 45,000 H.P. which would be developed at King River. At present inquiries covered 30,000 H.P., being 25,000 H.P. for the Mount Lyell Co., which was undertaking the Read-Rosebery Mines, Ltd., scheme for treating zinc-lead and other ores, and 5,000 for the Metals Extraction Co., London : there was no doubt that the Government would be able to dispose of the remaining 15,000 H.P. Regarding the smelters, the Government had received an offer which would cover all its interests ; the offer would be dealt with by a special Parliamentary Committee.

Uruguay.—A recent resolution of the Ministry of Finance states that in view of the necessity of replacing the fuel oil hitherto used by the State Electrical Department with other and dearer combustible, a rise in the prices of energy has become inevitable. In consequence the following rates are now to be charged :—When consumption does not exceed 1,000 KW.-hours per month, $0·055 per KW.-hour ; over that figure, $0·04.—*Review of the River Plate.*

Wednesbury.—SALE OF UNDERTAKING.—The T.C., on Monday last, decided to dispose of the Corporation's electricity department to the Midland Electric Power Co., Ltd. ; amongst the reasons for coming to this decision is that, with a population of approximately 30,000, there are within the borough four statutory authorities with enabling powers for the supply of electricity and gas for power purposes. The increased prices of materials of all kinds, the increased rates of wages, and the interim report of the Reconstruction Sub-Committee, indicating the creation of larger areas for the generation and supply of electricity, are considered sufficient grounds to justify the Corporation in disposing of the undertaking. The Midland Electric Power Co., Ltd., will take over all the property and assets of the undertaking on payment by the company to the Corporation of all the capital liabilities of the Corporation in connection therewith by 15 annual instalments of £5,000.

Wigan.—Loan Application.—The Council has approved the recommendation of the Electricity Committee to make application to the L.G.B. for sanction to borrow £65,000, for the provision of additional generating plant to meet the increasing demand.

Willesden.—Loan Application.—The Electricity Committee recommends that application be made for sanction to a loan of £5,400 for two 500-kw. converters at the electricity works.

Worcester.—Fuel Economy.—At a meeting of the T.C., last week, the electrical engineer reported the possibility of further restrictions in the supplies of certain classes of fuel, and recommended the replacement of the chain-grate stoker on No. 5 boiler with a four-retort Erith Riley stoker. He explained that the Council already had three of the Erith stokers. His report estimated the saving of fuel at £1,075, whereas the cost of making the alteration would be £820.

York.—The city electrical engineer has been unable to obtain priority for repairs to the 1,250-kw. turbine. The engineer reports that if further breakdowns occur at the generating station, the lighting and tramways will possibly be affected.

TRAMWAY AND RAILWAY NOTES.

Audenshaw.—Loan Sanction.—The D.C. has been informed by the Treasury that no objection will be offered to the borrowing by the Council of the moneys necessary to effect the purchase of its portion of the Oldham, Ashton and Hyde Tramways, provided there is no issue of bills, bonds or stocks.

Australia.—Year's Working.—The accounts of the Melbourne, Brunswick and Coburg Tramways Trust for the year ended September 30th last show gross revenue £28,674; total expenditure, including interest, £25,199; net surplus, £3,475. Of this, £1,233 has been placed to the renewals reserve account, and an equal amount to the maintenance fund. Car-mileage for the year 538 457; passengers carried, 43,614,593; working expenses per car-mile, including power cost, 8·359d.; total revenue per car-mile, 12·780d.

The report of the N.S.W. Railway Commissioners on the Government tramways, for the three months ended December 31st last, shows revenue £518,607, an increase of £17,767; expenditure, £421,592, a decrease of £14,617; car-miles run, 5,665,573, a decrease of 575,520 miles. The number of passengers carried decreased by 7,635,000.

The attention of the Queensland Home Secretary having been called to a circular issued by the Brisbane Electric Tramways Investment Co. to its shareholders objecting to the two new Tramway Bills introduced in the Queensland Parliament last session, Mr. Huxham (Home Secretary), in reply, stated that the Government simply wanted to give the company that to which it was fairly entitled. If no agreement was arrived at with the Government, the matter would be decided by the Courts. One of the Bills was for clearly defining sections over which a charge should be made of 1d. per mile. The Government wished to protect the public, and see that it obtained a fair return for its money. The Act provided that when local authorities were prepared to take over the tramways from the Government, they simply reimbursed the Government to the amount it had paid either in cash or debenture. In the meantime the tramways would be operated by the Commissioner of Railways.—*Sydney Daily Telegraph.*

Blackburn.—Arising out of the recent threatened strike of tramway workers, a conference was held at the Town Hall, last week, between members of the Corporation and representatives of the Employés' Association, and a settlement was arrived at on all points.

Bradford.—Bonus.—The decision of the Committee on Production in the recent demand of the women tramway workers of Bradford for the full award of £1 per week advance on pre-war rates, as granted to the men, is in favour of the Corporation's contention that the women are not entitled to the full extent of the advance. The Committee supports the Corporation's offer of an advance to the women of 4s. per week, making a total advance of 13s. per week. The dispute arose out of the terms of employment of the women, but the Committee on Production has decided that these do not entitle the women to the same rates as the men.

Carlisle.—Owing to the depletion of the staff of the tramway company, a Committee of the Corporation appointed to consider the question has recommended the Watch Committee to license suitable women as tramcar drivers until July 31st next.

Halifax.—Year's Working.—The tramway returns for the year ended March 31st show a record in receipts. The revenue was £126,506, an increase of £14,480 over the previous year. Of the receipts, £2,100 was from the carriage of parcels, an increase of £34. The car-mileage was 1,869,357, a decrease of 179,415, and the passengers carried numbered 22,822,341, an increase of 1,641,757.

Leeds.—Parcel Service.—The parcel-carrying scheme on the Corporation tramway system in connection with the efforts being made for co-ordination of transport came into operation on Monday. Special parcel cars are being run twice a day—at 10 a.m. and 4 p.m.—on three of the principal routes in the city, and various depôts *en route* have been arranged for the reception of the parcels. Mr. James Hamilton, son of Mr. J. B. Hamilton, the general manager of the Leeds tramway department, has been appointed manager of the parcel system.

London.—Sale of Tramcars.—It was stated at the last meeting of the L.C.C. that six small type tramcars had been sold to Southampton for £550 each. The Council has also sold ten to Rotherham, ten to Sheffield, six to Newport, and five to Bexley and to the Metropolitan and Electric Tramways. The cars had been sold or lent on the suggestion of the Ministry of Munitions.—*The Surveyor.*

Oldham.—Fare Revision.—The Tramways Committee has agreed to a revision of fares to meet increased expenditure. The present charge of ½d. for portions of double stages is to be discontinued, 1½d. and 2½d. tickets going to 2d. and 3d. respectively; workmen's return tickets are to be increased by 1d. each, and ½d. fares for children are to be abolished, though children are to be allowed to travel two stages for a penny. Last year's receipts were £23,000 more than in the previous year, but it is expected that the increased expenses will be almost as great.

Rochdale.—Increased Fares.—The Tramways Committee has had under consideration the question of increased tramway fares, and, in view of the heavy increases in wages and in the costs of materials, favours immediate steps by the B. of T. to obtain Parliamentary sanction to a 50 per cent. increase of tolls and charges.

Year's Working.—The Corporation tramway receipts for the year ended March 31st amounted to £102,204, an increase of £16,492 on the previous year, and 16,411,024 passengers were carried, an increase of 2,245,526.

United States.—In *Electric Traction* for March an account is given of the new high-speed line between Buffalo and Niagara Falls, which is to be opened shortly; this project was initiated no less than 26 years ago. The line has a total length of 22·7 miles, of which 16·5 miles is on private right-of-way; the overhead construction is of the catenary type, the supporting bridges being 200 ft. apart, with a No. 0000 trolley wire at 600 volts. Power is supplied to rotary-converter sub-stations at 11,000 volts. The journey between termini will occupy less than one hour.

Wigan.—At the last Council meeting, Councillor Lowe inquired the reason for the Tramways Committee recommending the appointment of a traffic superintendent, seeing that two years ago it decided to dispense with a traffic manager. Alderman Fletcher, in reply, said that what was done two years ago was considered right at the time, but no department had made such rapid strides as had the tramways since then. It had carried 1¾ million more passengers in 11 months than in the preceding 12 months, and this meant a tremendous increase of work and responsibility, and the time had arrived when the department should be reorganised.

TELEGRAPH AND TELEPHONE NOTES.

Bolivia.—Congress has authorised the establishment of wireless stations at Concepcion, San Ignacio, and Villa Bella. These stations, together with the one which will shortly be erected at Trinidad, will form the "second group" of Bolivian wireless stations.

New Company.—The Compagnie des Cables Télégraphiques of France is aiding in the formation of the Société de Radio-Télégraphie, which will have a capital of £1,500,000. The former company will subscribe 30 per cent. of the stock, the Marconi group 40 per cent., and the remainder will be taken by banks in Paris. The new company will absorb two concerns which manufacture wireless apparatus, and the Marconi Co. will bring in a wireless station at New York, established by the Marconi Wireless Telegraph Co. of America.—*T. and T. Age.*

New Telegraphic Printer.—At the Spanish Club on the 7th inst., Senor Matias Balsera gave a practical demonstration of a new telegraphic apparatus of his invention. The Balsera apparatus is worked on the keyboard system, has already been tested between the central telegraph stations at Madrid and Barcelona, and is said to have received the entire approval of the Spanish telegraph authorities. It is claimed for the invention that it has certain distinct advantages over the Hughes apparatus, the output being electrically, and not mechanically, controlled. The inventor claims that he can send out 45 words per minute, as against the 30 to 35 words sent out by the Hughes. The instrument, in the view of experts who were present, would serve admirably for short-distance transmission, but it is not claimed by the inventor that it could effectively replace the systems now in use for long distances, where the wire, and not the instrument, is the essential factor in rapidity of transmission.—*The Times.*

Norway.—A large wireless station has been completed at Jaederen on the Norwegian west coast. There is now an excellent wireless connection between Scandinavia and America.

Sweden.—The new Government wireless station at Karlsborg has a range of 5,000 km. The masts are 210 m. in height, and weigh only 25 tons; they are mounted on granite insulators, impregnated with paraffin, and are also interrupted in four places with insulators. The antennæ consist of 60 wires of phosphor bronze, 450 m. long, and are suspended from spiral springs. The counterpoise consists of bronze wire 1 mm. in diameter, which is insulated and supported at a height of 5 m. above the ground, covering an area of 95 ha.; this device has been adopted instead of an earth connection, in order to diminish the losses, and to obtain sharper tuning. Power is derived from the Trollhättan generating station, or from a stand-by plant at the wireless station.—*Dagens Nyhater.*

United States.—The report of the New York Telephone Co. for 1917 shows telephone revenue £12,592,200 and expenditure £9,733,500; with other income the total net earnings were over £4,060,000. There were 1,443,388 stations on the system, and with the associated systems the total number of stations was 2,565,913.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Dublin.—April 23rd. Electricity Supply Committee. Boiler house plant. See "Official Notices" to-day.

Malvern.—Electricity meters for a year, for the U.D.C. The Engineer.

Plymouth.—April 29th. Corporation. Turbo-alternator, converter, transformers, and switchgear. See "Official Notices" to-day.

CLOSED.

Sheffield.—City Council. Accepted tender; Staveley Coal & Iron Co., Ltd. Circulating water discharge pipes at the Emergency Power Station.

Wolverhampton.—Corporation Electricity Department. Accepted tenders:—

Gibbons Bros., Ltd., £52, iron staircase and handrail for the present boiler house flooring to the flooring level of the new boiler house annexe, together with railing on the landing.—J. Spencer, Ltd., £1,580, plus 10 per cent. for contingencies, steam, feed, and blow-off piping for the boiler house extensions.

Foster Bros., £146.—Steam piping for 5,000-kw. turbo-alternator set.

Ferguson, Pailin & Co., Ltd., amounting to £2,868, plus 10 per cent. for contingencies (total £3,154) for installation of four reactances.

Reyrolle & Co., amounting to £919, plus 10 per cent. for contingencies, (£1,010, including the supply of an additional rotary converter, costing £434) for alterations to switchboard to enable reactances to be installed.

Ferranti, Ltd.—House service type meters.

General Electric Co., Ltd.—Switch panel for rotary converter, £184.

A scheme suggested by the electrical engineer for the transport of coal from the railway siding adjacent to the electricity works has been approved, and the necessary automatic plant, rails, &c., are to be purchased for £475.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, April 13th. At 7 p.m. At the Swan Hotel, New Street. Paper on "Electroculture," by Mr. V. J. Hill.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 13th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Junior Institution of Engineers.—Monday, April 15th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Cylindrical Grinding," by Mr. W. D. Adamson.

Saturday, April 20th. Visit to the Lea Bridge Pumping Station of the Metropolitan Water Board.

Illuminating Engineering Society.—Tuesday, April 16th. At 5 p.m. At the Royal Society of Arts, John Street, Adelphi. Paper on "Light and Vision: The Physiology of the Retina," by Prof. W. M. Bayliss, F.R.S.

Electrical Power Engineers' Association (Northern Division.).—Thursday, April 18th. At the Grosvenor Hotel, Deansgate, Manchester. At 7.30 p.m. Ordinary meeting.

Chemical Society.—Thursday, April 18th. At 8 p.m. At Burlington House, Piccadilly, W. First Hugo Müller Lecture on "The Old and the New Mineralogy," by Sir H. Miers, F.R.S.

Institution of Electrical Engineers.—Thursday, April 18th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Overseas Distribution of Engineering Appliances," by Mr. L. Andrews.

(**Birmingham Local Section**).—Wednesday, April 17th. At 7 p.m. At the University. Paper on "Large Batteries for Power Purposes," by Mr. E. C. McKinnon.

(**Newcastle Local Section**).—Monday, April 15th. At the Mining Institute. At 6.45 p.m. Discussion on "The Report of the Coal Conservation Sub-Committee on Electric Power Supply in Great Britain."

Institution of Mechanical Engineers.—Friday, April 19th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. General meeting.

Royal Institution of Great Britain.—Friday, April 19th. At Albemarle Street, W. At 5.30 p.m. Lecture on "The Use of Soap Films in Engineering," by Major G. I. Taylor.

NOTES.

Electrical Conference in India.—A conference of Electrical Engineers and Inspectors to Government was opened in Calcutta on January 7th by Mr. J. W. Meares, who referred to the beneficial results accruing from the proceedings at the previous conference (in December, 1916). Many of the recommendations that they had put forward were still under the consideration of the Government, and the agenda outlined by Mr. Meares contained abundant materials for discussion.

Unipolar Induction.—In the *Physical Review* for December, Prof. G. B. Pegram discussed the theory of unipolar induction in the light of the electron theory, and concluded that the E.M.F. was generated, not in the external conductor, but in the rotating magnet, the conductor merely completing the circuit. It appears that no E.M.F. is set up in stationary parts of the circuit.

Trade Organisation Development.—A conference which is to take place between trade representatives and Government representatives in the Saddlers' Hall, London, to-day, April 12th, will mark a new point in the process of trade organisation, to which the country is now giving so much attention. On behalf of the Government, three Ministries will be represented by their respective Ministers:—Dr. Addison, Minister of Reconstruction; Mr. G. H. Roberts, Minister of Labour, and Mr. Hayes Fisher, President of the Board of Trade. The trade immediately concerned on this occasion is the made-up leather goods and belting industry, and representatives both of employers and of employed will be present. The object of the meeting is to promote the formation, for this particular industry, of an "Interim Industrial Reconstruction Committee," and the movement is of interest to people of other trades, because this committee, it is hoped, will be the first of many similar committees, to be formed by such trades and industries of the country as cannot see their way clear to forming at once a full industrial council for their trade on the lines recommended in the First Whitley Report. The Interim Industrial Reconstruction Committee is to serve as a stepping-stone or half-way house to the full Industrial Council status. The First Whitley Report, it will be remembered, advocated a Joint Standing Industrial Council for each trade, but this recommendation was regarded as practicable only in such trades as had attained a considerable degree of industrial organisation as regards both employers and workers. Interim industrial reconstruction committees are now advocated for such industries and trades as have not attained so complete a degree of organisation, and also for more highly organised trades in cases where there are difficulties in the way of forming joint standing industrial councils. They are intended to fulfil temporarily some of the functions allotted to industrial councils, but they have also one added function of great importance, namely, to promote organisation both of employers and of employed in their industry, until each side has reached that degree of organisation which will admit of full industrial councils being formed. They are to give their attention also to other urgent problems which in the case of more fully organised industries will be dealt with by industrial councils. Among these problems are all the many trade difficulties embraced under the general head "demobilisation" and the re-absorption into industry of men from the various branches of national service at home and abroad; also the problems that will arise from the shortage of raw materials and the general shortness of money. They will be asked to consider also such questions as new industries, the proper disposal of Government surplus stores, and other questions affecting the general welfare and prosperity of their industries. But the great function of interim industrial reconstruction committees will be to bring about, each within its own industry, that degree of organisation, both on the part of the employers and on the part of the workers, and jointly on behalf of both, which will make possible the establishment for that trade of a full industrial council which can speak for its trade with one voice, act for it with the unanimous support of all its members, and represent it in the councils of the nation.

The Formation of Diamonds.—For the past 30 years, unknown to the scientific and engineering world in which, as the inventor of the steam turbine and other devices, he is so famous, the Hon. Sir Charles Parsons has been conducting experiments on the formation of the diamond. The results of his work in this fascinating field of research—work which has a direct bearing on many branches of pure and applied science—are to be made known for the first time at the eighth annual May Lecture, which he is to give before the Institute of Metals on May 2nd.

In view of the special character of the occasion, the Council of the Institute has decided to make this an open meeting. Those desiring to be present should apply—enclosing a stamped and addressed envelope—for cards of invitation to Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. 1, who will also be glad to supply particulars of membership of the Institute, a ballot for election to which is due to be held on April 24th.

Manchester Electricity Works and the 12½ per Cent. Bonus.—Mr. J. Cunningham, secretary of the Shops Committee of Manchester Corporation electricity generating stations, states that an application will be made for a 12½ per cent. bonus, to apply to all workmen on munitions, directly or indirectly, or on auxiliary work.

The application was to be heard by the Government Committee on Production in London yesterday, and affects all Corporation and private electricity undertakings throughout the country and the building trades in general.

National Kitchens.—Of three national kitchens to be established in Hackney, one is to be fitted for operation with gas and two for operation with electricity. The Electricity Committee is to provide the electric cooking apparatus at the same price as the apparatus in the gas kitchen, and will maintain the two electric kitchens at the same price per kitchen as the gas kitchen. The Electricity Committee will further supply fuel and electrical energy to the electric kitchens at the same price per portion served as the cost of fuel per portion served in the gas kitchen.

Whitley Committees.—The *Times* states that a scheme has been formulated for the establishment of a Joint Industrial Council for the chemical trade on the lines of the recommendations of the Whitley Report. The Ministry of Reconstruction, which is taking an active interest in the project, has invited the Association of British Chemical Manufacturers to appoint representatives to serve on an "interim" Industrial Council.

Fatalities.—On March 27th an inquest was held concerning the death of James Hall (16), a Manchester Grammar School boy, who met with a fatal accident at the L. & Y. Railway Co.'s works, Newton Heath. Evidence showed that deceased, with about 40 other boys, went to the works on Saturday, March 23rd. They were instructed to go to a cabin near by and to have a wash. Along with two other boys, deceased went to the traverser's shed. They had no business there. A witness named Cummings said he put on the main switch, and when they had jumped on the traverser Hall set it in motion, and they rode up and down once or twice. Suddenly the machine stopped, and witness saw Hall lying down. He thought he must have had an electric shock, but found his arms had got caught. They had ridden on the traverser many a time. Mr. R. G. M'Laughlin, the works manager, said the traverser was electrically driven and was being repaired, and the guards for the time being had been taken off. A. E. Wilson said he found deceased's right arm pinned to the cog-wheel. He died on Sunday. The jury returned a verdict of "Accidental death," and expressed the view that some charge hand or responsible person should be in charge of the boys until they were off the premises.

At Barrow-in-Furness, on Tuesday, the Coroner of Furness concluded an inquiry into the death of Jane Mill Jones, a sweeper-up at the Naval Construction Works, which occurred in hospital on March 28th, as the result of burns sustained through an explosion at an electric motor, which ignited her clothing. John Worlsey, tool setter, said he saw the deceased near the motor, which was on the ground, and she had a shovel in her right hand, which she was pulling behind her. The shovel, he thought, must have caught the wire to the motor, because there was an explosion, and the woman was enveloped in flames. She was removed to hospital. James Ferguson, charge hand electrician, said that on hearing of the affair, he at once went to the place, and, on examining the electric motor, found that undue pressure had been placed on one of the leads which came through a pipe through the ground. It had been wrenched from its terminal, as there was evidence of burning on the motor casing. The explosion was a flash to earth caused by the short-circuit, which was made by the terminal wire touching earth; the flash would set fire to anything of a combustible nature, and would account for the deceased's clothing becoming ignited. In reply to a question, Mr. H. Clarke, H.M. Inspector of Factories, said he had seen the motor, and would say that it was reasonably safe. They did not know, however, how the wire was connected with the terminal, whether by an eye or a hook. If it had been connected with an eye it would have been impossible to pull it off the terminal. The wire had been pulled away. The jury returned a verdict: "That the deceased accidentally had her clothing set on fire by an explosion caused by the severance of the line at one of the motors, and died from the burns received."

An electrician named John Hexham (48), of Barrow, went into the storeroom of a floating dock to disconnect some wires in a junction-box. This box was 8 ft. from the ground, and, apparently, he would stand on a plank 4 ft. from the ground. After some time he was found on the floor, having apparently fallen from the plank. He died the same day. Verdict: "Accidental death."

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending April 20th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Capt. W. Hynes.

Monday, April 15th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, April 16th.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, April 17th.—No. 1 Company, Entrenchments, &c., 6.30. Recruits' Drill, 6.30.

Thursday, April 18th.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, April 19th.—Musketry, 5.30—8.

Saturday, April 20th.—Commandant's Parade, 2.45, for drill in Hyde Park. Drill Order, with rifles.

Special Notices.—All drills will be held at Headquarters unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Warwickshire Volunteer Engineers.—Warwickshire Engineers (Volunteers) were in training in camp for Easter at Chadwick Manor, Knowle, under the command of Major D. Shanks. The syllabus of training was prepared by Capt. and Adjutant S. T. Pemberton, and his efforts to make the camp a success were ably seconded by Capt. E. J. Jenkins, Lieut. G. O. Donovan, and Second Lieut. W. H. Varnom. The camp was formed on Thursday, March 26th. On Friday air line and cable sections were at work; on Saturday Col. D. F. Lewis, C.B., Commanding Officer of the Warwickshire Volunteer Regiment, inspected the men and their work. The Colonel expressed his satisfaction at the soldierly manner in which the officers and men paraded. A concert was held on Saturday, presided over by the Commanding Officer. On Sunday the Engineers attended Church Parade at Knowle Church, and on Easter Monday the camp was early astir and all sections at technical work. The motor air line section, under Lieut. H. Varnom, ran out wires on poles, as per schedule arranged, to buzzer instrument stations, and the cable section, under Capt. E. Jenkins, ran out similar telephone lines to field telephone stations. The technical work was carried out in a creditable manner, and the officers, non-coms., and men were complimented by the C.O. on their accomplishment. The afternoon was devoted to sports, and in the evening another concert was held. On Tuesday the morning was devoted to loading wagons and clearing up, and the Engineers and equipment returned to headquarters, Thoro Street Barracks, Birmingham, on Tuesday afternoon. In addressing the officers, non.-com. officers and sappers, Major Shanks complimented all on their work. He specially praised the excellent work of the Adjutant, Capt. S. T. Pemberton, to whom was allotted the task of organising the camp and making all arrangements for the training and comfort of the men. Lieut. G. O. Donovan acted throughout the camp as orderly officer, and had the whole camp under firm, but kindly, control from start to finish. Capt. Jenkins and Lieut. Varnom both carried out their duties in an efficient manner, and the sappers benefited greatly by the training they received under these capable officers.—*Birmingham News.*

Appointments Vacant.—Mains assistant for Sunderland Corporation (£225); junior shift engineer for Gravesend Corporation (55s.); shift engineer for Farnworth (60s. + 12½ per cent.); fitter and general station hand (£250) for the Electric Light Station at Lagos, Nigeria; cable jointer (1s. 4d. an hour) for the Eccles Corporation Electricity Department; charge engineer for the Dover Corporation Electricity Department; assistant shift engineer (70s.) for the Battersea Corporation Electricity Works. See our advertisement pages to-day.

Dr. Ferranti's Cotton-spinning Patent.—On Wednesday last, Mr. Justice Sargant, in the Chancery Division, concluded the hearing of a petition by Dr. S. Z. de Ferranti and Messrs. Coates, cotton spinners, of Paisley, for an extension of Letters Patent granted to Dr. Ferranti in 1903 for an invention relating to spinning, twisting, and doubling machinery. There was no opposition, and his Lordship, in the result, reserved his formal judgment, but said he was disposed to grant an extension for seven years.

Patents and Alien Enemies.—The Board of Trade has granted licences in respect of 23 patents issued to the firm of R. Bosch and others, dating from 1908 to 1913, to the British Lighting and Ignition Co., Ltd., and the Public Trustee has granted a licence to the same company in respect of Patent No. 10,380/14, issued to R. Bosch.

The I.E.E. Wiring Rules.—The Council has adopted a recommendation of the Wiring Rules Committee that Wiring Rule No. 62 shall not apply to consumers' electric supply meters for currents up to 100 amperes, made in accordance with the Engineering Standards Committee's Specification No. 37. The rule referred to relates to the method of connecting conductors larger than 7/18 s.w.g. to the terminals of the meter, requiring the use of cable thimbles.

Production of Home Fuel Oil.—The Minister of Munitions, in agreement with the Secretary for the Colonies and the Petroleum Executive, has appointed a Committee to inquire into certain matters relating to fuel oil, with the Marquis of Crewe as chairman. The Committee will consider the report which has been rendered by the Petroleum Research Department on the production of fuel oil from home sources.

The Fixation of Atmospheric Nitrogen.—In the *Zeitschrift des Vereines Deutscher Ingenieure* H. Andriessens describes an arrangement working on the same principle as the Birkeland furnace for obtaining nitrogen from the direct combustion of air, and for which 80 per cent. higher output is claimed. The Birkeland furnace is based on the assumption that a maximum yield of fixed nitrogen is obtained by spreading out the arc so as to obtain a maximum reaction surface. The Andriessens furnace, on the other hand, aims at obtaining maximum linear extension of the arc and minimum surface of the flame volume, on the ground that the reaction velocity between nitrogen and oxygen is extraordinarily high, so that the sooner the products can be removed from the flame zone the less the extent to which dissociation will occur. The nitric oxide should be cooled down in the shortest possible time, and previous methods do not take account of this condition. The arc should be lengthened as much as possible, and its surface kept as small as possible. To effect this, an air blast is delivered between two vertical rod electrodes set below but in the same vertical plane as the line joining the poles of a powerful electromagnet. The net result of air blast and magnetic field is to spread the arc over a surface limited by a helix which may have a pitch of only a few mm. The air velocity may be four times that usual in the Birkeland furnace. From a 35-kw. furnace the yield may be 70 gm. (referred to 100 per cent. nitric acid) as compared with 30 to 45 gm. from a Birkeland furnace of equal power.

The *Norsk Hydro-Elektrisk Kvaelstofaktieselskab*, Christiania, denies that the Andriessens method is so much superior to the Birkeland method, and states that the output of furnaces of the latter type is considerably higher than is stated by Andriessens; the latter replies that his results incorporate the experience of eight years' work, and that no authoritative figures have ever been given of the performance of the Birkeland furnace.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—At a meeting of the Belfast Corporation last week, Coun. Sir Crawford M'Cullough drew attention to the fact that the tramway manager, Mr. J. S. D. Moffatt, had been recommended for the appointment of deputy manager of the Liverpool Corporation's tramways, and that the Council in committee, with a view to retaining his services, recommended that his maximum salary be fixed at £1,200, to be reached by annual increments of £100 in September, 1918, £100 in September, 1919 and 1920, and £50 in 1921. He understood that Mr. Moffatt would accept those terms. The recommendation was unanimously adopted.

The Bath Electricity Committee has increased the salary of Mr. A. R. Shapley, deputy electrical engineer, from £275 to £325 per annum.

Worthing Corporation Electricity Committee has increased the salary of Mr. H. A. Best, the assistant electrical engineer, from £175 per annum to £195, with two further £10 increments to a maximum of £215.

Mr. Percy Priestley, general manager of the Oldham Corporation tramways, has been appointed deputy manager of the Liverpool Corporation tramways, subject to the approval of the City Council, at £800 per annum.

The Bexhill-on-Sea T.C. has increased the salary of the chief assistant electrical engineer to £175 a year.

Mr. J. Makin, electrical mains superintendent of the northern district at Stoke-on-Trent, on leaving to become deputy electrical engineer and tramways manager at Bexley Heath, has been presented by the staff and townsmen with an illuminated address and a gold watch.

Eastbourne Electricity Committee has recommended the payment of an honorarium of £50 to the electrical engineer, in recognition of extra work caused by the shortage of staff.

Doncaster Electricity and Tramways Committee has recommended that the salary of Mr. T. Potts, acting traffic manager, be advanced from £206 to £250 a year.

Birkenhead Tramways Committee has recommended the T.C. to increase the salary of Mr. C. Clarke, tramway manager, from £450 to £500 a year, with annual increments of £50 to £650.

Mr. C. J. Spencer, the Bradford tramway manager, has been released by the Admiralty, in response to urgent pressure from the city that he might be allowed to take up his old duties. The Admiralty write that they part with Mr. Spencer with great reluctance, and convey their thanks to the tramway department and the Council for the loan of that official to be Assistant Director (Labour Division) of the Shipyard Labour Department. The Admiralty hope to utilise the advice and experience of Mr. Spencer on a future occasion.

Mr. James Hamilton, son of Mr. J. B. Hamilton, the general manager of the Leeds Corporation tramways, has been appointed in charge of the new parcel-carrying scheme in connection with the Leeds tramways.

Northampton T.C. has increased the salary of the tramway manager from £350 to £400 a year.

The York Electricity and Tramways Committee recommends the City Council that the offices of city electrical engineer and tramway manager be amalgamated at an inclusive salary, and that the salary of the engineer and tramway manager, Mr. J. W. Hame, be increased from £550 by £100, with further annual increments of £50 to a maximum of £800, such increase to cover the 12½ per cent. advance under the Askwith award, if held to be payable.

General.—Mr. C. W. Crosbie has resigned his position with Messrs. Ferranti, Ltd., on his appointment as an electrical engineer under the Air Ministry.

Captain J. Young has been transferred to the Indian Army and appointed Deputy Assistant Director of Military Works at Army Headquarters, India. He was formerly lieutenant in the Highland Light Infantry, and, in civil life, electrical engineer with the Scottish Boiler Insurance and Engine Inspection Co., Ltd., Glasgow.

Mr. F. K. Cooke, F.C.I.S., late secretary with the Unbreakable Pulley & Millgearing Co., Ltd., and the Cooper Roller Bearings Co., London and Manchester, has been appointed secretary to John Wood & Sons, Ltd., of Barley Brook Foundry and Engineering Works, Wigan.

Mr. Joseph Rippon, of the Bermuda Cable Companies, and chairman of the Bermuda Contingent Committee, has been awarded the O.B.E. for services in or for the Overseas Dominions, Colonies, and Protectorates in connection with the war.

Dr. J. Erskine-Murray, who is now engaged in Government service, has retired from the firm of Messrs. Clark, Forde, Taylor & Erskine-Murray, and Mr. A. L. Dearlove will be joined by Mr. E. S. Heurtley as a partner in the firm, which will revert to the old style of Messrs. Clark, Forde and Taylor. Mr. Heurtley is a member of the Institution of Electrical Engineers, and is well known in the cable world as the inventor of the Heurtley magnifier relay, and other important inventions in connection with submarine cables. We wish Mr. Dearlove and his partner the success which attended the old firm (friends of our youthful days) through so many long years of activity.

Roll of Honour.—The *Times* records that Lieutenant G. K. Steinberg, M.C., M.G.C., who was killed on March 22nd, aged 25, was educated at University College School, and on leaving entered the patents department of the British Thomson-Houston Co., Ltd.

The death in action is announced of Second-Lieutenant E. T. Wilson, Royal Warwicks, of the B.T.H. Co., Rugby.

The death in action is reported of Sergeant B. Gill, West Yorkshire Regiment, and formerly with Messrs. Ingleby and Co., Ltd., manufacturing electrical engineers, Leeds.

Captain George Vallance Rowbottom, M.C., Oxford and Bucks. L.I., reported missing since March 21st, was prior to enlisting in the R.N.D. an electrical engineer at Oxford.

Sergeant J. Yates, R.G.A., who has been awarded the Belgian Croix de Guerre, was formerly a motorman on the Burnley Corporation tramways.

Sapper B. Armstrong, of Seedley, Manchester, killed on March 29th, was formerly employed at the British Westinghouse Co.'s Works, Trafford Park.

Private A. C. Entwistle, Manchester Regiment, who has died of wounds, was employed in the Manchester Corporation electricity department at the Town Hall.

Sapper H. Handley, R.E., who has died of wounds, was employed by Messrs. Electromotors, Ltd., Manchester.

Private J. A. J. Wainer, Manchester Regiment, seriously wounded, was employed by Messrs. Royce, Ltd., Trafford Park.

Second-Lieutenant R. P. Shaw, formerly an electrician with the Rochdale Electric Co., has been killed in action, aged 24 years.

Captain and Adjutant Harold Smith, formerly chief assistant to the Leeds tramways traffic superintendent, has died from wounds.

Second-Lieutenant A. D. Moore, Essex Regiment, formerly in the employ of the India-Rubber Co., Silvertown, was killed on 23rd ult. Corporal J. H. Flett, Royal Fusiliers, of the same company, has been wounded and missing since November 30th last. Sergeant A. H. Taylor, R.F.A., who was in the waterproofing department of the India-Rubber Co., was gassed in France in March. Private W. L. Jackson, Middlesex Regiment, formerly in the cashier and buyer's office of the India-Rubber Co., is now a prisoner of war.

Obituary.—Mr. Robert Winthrop Blackwell, M.I.E.E.—By the sudden death of Mr. Robert W. Blackwell, after a very short illness, at his residence, "Elmbank," Hampstead, on March 28th, the electrical profession loses one of the few remaining and best known pioneers of electric traction, and one whose name has been intimately connected with this most important branch of electrical engineering, both in the United States and in this country, for the last 35 years. Born in 1858, Mr. Robert W. Blackwell graduated as M.A. and B.L.L. at Princeton University, where he was a contemporary of President Wilson, and afterwards practised as a Councillor of Law at the American bar. Attracted, however, by the great demand for mechanically-operated street cars, the need for which was so urgently felt in the United States, he jointly with Mr. Edward W. Bentley and Mr. Walter H. Knight, founded in 1883 the Bentley-Knight Electric Railway Co., of New York, which installed and equipped an electrically-operated tramway system in Cleveland, Ohio, opened for traffic in 1884, and which was the first line to be operated electrically as a commercial undertaking. Mr. Blackwell, as a contemporary of Sprague, Vanderpoel, and Edison, was intimately associated with the great pioneer work carried out in the U.S.A. between 1883 and 1889. He was actively engaged with the management of his company until, in 1889, he transferred the Bentley-Knight Co.'s interests to the Thomson-Houston Co., of Lynn, Mass. Mr. Blackwell was shortly afterwards summoned to England to give evidence before Parliament on behalf of the first Bill promoted by the Central London Railway Co., and it was the experience he gained during this stay which showed him the great prospects of electric traction in the United Kingdom, and which eventually, in 1890, induced him to take up his residence in this country. In 1890 he became associated with Messrs. Greenwood & Batley, of Leeds, in conjunction with whom he opened an office in London for the purpose of introducing electric traction on the tramway systems in the United Kingdom. In 1894 Mr. Blackwell founded the firm of Robert W. Blackwell & Co., which, ever since that time, has been well known as one of the leading firms of merchants, manufacturers, engineers, and contractors. In 1895 Messrs. Blackwell secured the contract from the British Thomson-Houston Co. for the construction and electrical equipment of a new tramway in Bristol, and the work they there carried out was so satisfactory that it at once secured their position as leading contractors in the electric traction field. The great financial success secured by this first electrification on a commercial scale served as an incentive to many others. As engineers and contractors, Messrs. R. W. Blackwell were henceforth connected with a very large number of the electric traction systems installed in this country. They supplied materials and engineering advice to a large number of continental firms, and they were the expert advisers on traction matters to such firms as the Oerlikon Co., Schuckert & Co., and Ganz & Co., and their designs and specialities are to be found in a very large number of electric tramway installations throughout Europe, Africa, Asia, and South America. It was they who designed the originally successful trolley standards for top-seat tramcars, and who first standardised the pole and bracket arm construction for overhead lines. Wherever anything new was to be seen, or experience was to be gained, there Mr. Blackwell went, or sent his engineers or representatives, to investigate and test, with the result that purchasers always came to him for information and advice. He exhibited in 1897 at the Brussels Exhibition an exhibit which was one of the most interesting in the whole British section, and he was a member of the International Jury there. It is interesting to note that, although American born and a very prominent member of the American Society in London, all Mr. Blackwell's associates and staff were British. His firm carried out many important works for English railway companies, including the Great Western, the Great Central, and the London, Brighton & South Coast Railway Companies. The work carried out for the last-mentioned company includes some of the most difficult bits of construction ever put up, and was erected under the most unfavourable conditions. The work was carried out to the design, and under the supervision, of Mr. Philip Dawson, M.Inst.C.E., &c., the consulting electrical engineer of the L.B. & S.C. Railway Co., who for the first 15 years of Mr. Blackwell's activities in this country had been intimately associated with him. This line has now been in operation for over nine years, and, thanks to the observation of the principle always inculcated in his staff by Mr. Blackwell of never doing bad work, the results have fully justified the confidence placed in him by this company, and have falsified the many criticisms made against the adoption of the overhead system, as well as the prophecies as regards the high cost of maintenance, frequent failures, and interruption of service made from so many sides when the decision of the Brighton Co. to adopt the overhead system first became known. As founder and chairman of Robert W. Blackwell & Co., Ltd., his name is a household word among those connected with electric traction throughout the world. Not only as an engineer and contractor, but in many other directions Mr. Blackwell showed an initiative by building up a most successful roofing business, the material being made in his own works, by the manufacture in this country of apparatus and materials which had previously had to be imported from abroad, and by doing everything he could to encourage British enterprise. He was for many years chairman of Messrs. Johnson & Phillips, the well-known electrical engineers and cable manufacturers, and did very much to bring them to the high pitch of prosperity they have reached to-day, and he was as much loved and respected by his co-directors and the employés of this firm as he was by those of Messrs. Blackwell & Co. He had many outside interests. He was in charge of most of the arrangements for looking after the American Military Mission during their visit to this country, and he was a great supporter of the American Red Cross and kindred societies.

Robert Winthrop Blackwell.

Mr. J. S. Brodie.—Mr. John S. Brodie, borough engineer of Blackpool, last year's President of the Institution of Municipal and County Engineers, passed away suddenly on Monday, aged 67 years.

Will.—The late Sir J. Wolfe Barry left £278,362, of which £225,033 is net personalty. Sir John left £250 to the Benevolent Fund of the Institution of Civil Engineers, and £200 to the Benevolent Fund of the Institution of Mechanical Engineers. On the death of his widow, a further £1,000 goes to the Benevolent Fund of the Institution of Civil Engineers.

CITY NOTES.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Col. R. E. Crompton, presiding at the annual meeting, said that during 1914, 1915, and 1916 there had been a progressive falling off in their units sold, but his forecast of a year ago that the tide had turned in their favour had been confirmed to the extent of nearly half a million units. The increase in output, and the increased charge of 10 per cent. to certain of the units sold had increased the revenue by £10,500. The number of unoccupied houses in the district had slightly decreased. The total cost of generating had increased by £6,041, distribution costs had slightly advanced, and rates and taxes had largely increased. The larger revenue had enabled them to increase the amount put to depreciation; they hoped to put by still more when conditions were more favourable. They had also increased the dividend by 1 per cent., and the amount of the carry-forward. Fuel was obtained with difficulty, and its quality was poor. That increased labour charges, as larger quantities of coal had to be handled, and more ash was produced. The scarcity of materials for maintenance, and the practical impossibility of getting any repairs carried out at manufacturers' works, had entailed on them the whole duty of repairs; this had been done efficiently, but it certainly added to the expenses. Their supply for heating and cooking had considerably increased, owing probably to consumers finding difficulty in obtaining domestic coal, and deciding to install electric heating apparatus. This was a useful public service, as it caused reduction in the total consumption of fuel, which was very wasteful in domestic fireplaces. Partly due to this cause, the company's showroom and sale department had been very fully occupied, so that the sales had nearly doubled during the year. In fact, more orders had been received than they could carry out with their reduced staff, and 45 per cent. of the work had been handed over to local contractors. It would not be wise to expect much improvement, if any, during the present year. They would do very well if they kept up to the present mark of profit earning. Other difficulties were in prospect, and they felt it necessary to again increase the prices by 10 per cent., making the total advance on pre-war prices 20 per cent. This compared very favourably with the increase in the price of other commodities, and with the purchasing power of a sovereign as compared to peace time.

Charing Cross, West End, and City Electricity Supply Co., Ltd.

Mr. W. F. Fladgate, presiding at the annual meeting on March 21st, referred to the great difficulties of the year. Though the sale of energy had increased, the increase in expenses had been correspondingly greater. Coal, because of price increase and quality decrease, was a serious matter. At Bow station the cost of coal increased from £59,365 to £87,767. Dealing with the West End undertaking, sales of current had increased by £13,500, but the cost of fuel was higher by no less than £18,500, £1,500 for the internal-combustion engines, and £17,000 for the purchase of energy from the City undertaking. The increase in purchase was due to the difficulty in getting fuel for the West End plant, and in getting repairs done to enable them to use it. Every item of expenditure was increased, particularly wages, with the result that, though the total receipts were £15,000 more than for 1916, the expenditure increased by £25,000. In the case of the City undertaking, the receipts were £35,000 better, but practically every item of expenditure increased, and the balance carried to revenue account was the same as in 1916. During 1917 they had made no increase in the price of current, but a very considerable increase must now be made. In the City area they were handicapped by the provisions of the Order. It was obtained many years after the other London Orders, and at a time when the price of current had been much reduced. Their maximum was fixed at 5d., and at that time it was probably not an unreasonable figure. The effects of the war had shown that it was an extremely unfair one, but the Board of Trade had not, at present, seen their way to increase it. They hoped to be able to satisfy them of the unfairness of the position that one company out of all the London companies should be prevented from charging what was now only a reasonable price for the supply of electric current in one half of their area. The price of power was not so circumscribed, and consequently they would be able materially to increase it. They would probably in any case have had to increase their charges, but the 12½ per cent. rise of wages imposed by the Ministry of Munitions, added to the increase of wages that they had already given, had made it imperative. Not only would that 12½ per cent. increase their labour bill, but indirectly it would increase the price of almost every material that they had to buy. Referring to the extreme disabilities under which they had been labouring, he said that it had often been a matter of anxiety to the board to know whether they could go on with the work, but by the help of the employés they had been able to carry on up to the present. One of the After-the-War Committees had reported upon the position of the electric light industry. No final report had yet been issued, but there had been interim reports, one in particular dealing with the coal supply. He asked them to postpone their judgment on these interim reports, and not to consider them too seriously. They were by no means unanimous—in fact, to some extent they were contradictory. Incidentally, the London companies were more or less blamed for not having supplied energy at a cheaper rate, and so made it more available for general use. He again protested against this charge, as he believed it to be unfair. Whatever might be decided as regards other districts, the London area should be dealt with as an individual one. He had personally endeavoured for many years to bring about an amalgamation of the London companies, as he believed that they were fully competent, under proper conditions, to carry out the whole work for the London area, and would no so better and more economically than any other possible combination. If the Board of Trade had sanctioned the companies' Bill promoted in 1908, they would have been able to deal successfully with the whole of the London district. He believed that an amalgamation of the London companies would be for their benefit, and for the benefit of the L.C.C., who had the ultimate right of purchase. In the midst of war it was unwise to say anything as to the future. The electric lighting industry was perhaps less immune from consequent troubles than most other industries. Depending as they did largely upon coal supply, the work of the enemy submarine had been a very serious menace to their prosperity, even to their very existence.

W. T. Henley's Telegraph Works Co., Ltd.

For the year 1917 the profits were £238,725, from which are deducted debenture interest and depreciation, &c., £75,857, leaving £162,867, plus £69,730 brought forward, making £232,597. There is transferred to reserve for depreciation of trustee securities £2,801, to reserve £25,000, to special war allowances reserve £5,000. After paying the preference dividend, the ordinary shares receive 15 per cent. and a bonus of 10s. per share, less tax, leaving £112,042 to carry forward.

Payment has been made to the Inland Revenue of the amount of Excess Profits Duty due to the end of the year 1916, and provision has been made in the accounts in respect of the liability for the year 1917.

Provision has again been made for special depreciation on the machinery in the factories which has been running day and night on Government work, and for machinery which has been bought specially for war purposes which will be useless, or of problematical value, after the war.

The income-tax is charged to the profit and loss general account, instead of to the profit and loss account, as was the case in previous years. This has been done at the desire of the auditors, and should be noted in making a comparison of the balance carried to profit and loss general account with previous years.

It is proposed to sub-divide the £5 ordinary shares of the company into shares of £1 each, and to form a Tire Co., having a share capital of £200,000, the whole of which will be held by the company, also to increase the ordinary share capital of the company by £200,000, and to distribute that amount in fully-paid shares as a bonus amongst the ordinary shareholders. The consent of H.M. Treasury has been obtained to the issue of the £200,000 ordinary shares, but authority to issue shares of the Tire Co. has not yet been received.

After the business of the annual meeting (April 19th) has been disposed of the special resolutions respecting capitalisation of the reserve and the formation of a Tire Co. will be submitted.

W. T. Glover & Co., Ltd.—The result of trading in 1917 is a credit balance of £40,439, plus £22,025 brought forward. After meeting the interest on the 4¼ per cent. first and 5 per cent. second mortgage debenture stock, and paying £5,786 for excess profits 1915 and 1916, £4,000 is transferred to the trustees of the second mortgage debenture stock, 5 per cent. is paid on the preference shares, less income-tax, £2,500 is transferred to first mortgage debenture redemption fund, a dividend of 5 per cent. and a bonus of 2½ per cent., less tax, are to be paid on the ordinary shares, £20,000 is put to reserve fund, and £10,770 is carried forward, subject to Excess Profits Duty. The redemption fund for the first mortgage debenture stock will now stand at £45,500, that for the second mortgage ditto at £44,725, and the reserve fund at £80,000, making a total of £170,225.

Folkestone Electricity Supply Co., Ltd.—Notwithstanding the adverse conditions of 1917, the profits are satisfactory. The equivalent of 7,376 8-c.p. lamps were added. The price to consumers was advanced, but the increased revenue has not compensated for the additional expenditure on fuel and labour. The profit from the three undertakings (Folkestone, Sandgate, and Hythe) were £14,633. Dividend on the ordinary shares, 7 per cent. for the year; £4,262 to depreciation fund; £1,000 to reserve; £2,643 carried forward.

Willans & Robinson, Ltd.—According to the "Financial Times" the directors of this company, after consultation with the board of Dick, Kerr & Co., which now holds the majority of the shares in the company, propose to modify the arrangement with the "B" preference stockholders.

Dublin & Lucan Electric Railway Co.—Out of the available balance of £604 for 1917, the preference dividend is to be paid for one half-year, absorbing £475, leaving £129 to be carried forward. At the meeting of the company, Mr. J. W. Hill, who presided, said that under the coal conservation scheme the Government had ordered a very considerable reduction in all railway services, and in the case of this company it would necessitate a reduction of 25 per cent. in the existing reduced service, such reduction taking effect on April 25th.

Launceston & District Electric Supply Co., Ltd.—During 1917 the revenue receipts were £1,073, against £1,102 in 1916, and the working expenses were £620. Consumers increased from 227 to 246, and lamps connected from 6,413 to 7,698. Motors connected now number 16, with a total of 48 h.p. Gross profit £453. After deducting bank charges and preference dividend, paying 2 per cent. on the ordinary shares, putting £135 to depreciation, writing £50 off preliminary expenses, and putting £25 to reserve, £25 is carried forward.

American Telephone & Telegraph Co.—The report for 1917 states that net earnings were $48,940,466, or $4,197,090 more, after providing for Federal income and excess profits taxes payable in 1918. Interest charges were $10,469,360, and dividends at the regular rate of 8 per cent. per annum $32,481,613. Of the resulting balance there were carried to reserves $2,500,000, and to surplus $3,489,492.—*Financial Times.*

British Westinghouse Electric & Manufacturing Co., Ltd.—The directors recommend a dividend of 7½ per cent. on the preference shares for the year ending December 31st last.

Consolidated Electrical Co., Ltd.—Dividend, 2½ per cent. on the ordinary shares, leaving £2,947.

STOCKS AND SHARES.

Tuesday Evening.

The news from the Western Front continues to be the predominant factor in Stock Exchange markets. Besides this, however, there are two others of nearly as great interest in the City, to wit, the Man-Power Bill and the forthcoming Budget. Details of the former will have been published before this article, and therefore the immediate effect upon Stock Exchange prices can only be surmised. In advance, members of the House were disposed to think, having regard to the prophecies so freely made, that business in securities would be considerably affected, and that if a large number of men between the ages of 41 and 50 were called up, the influence upon prices would be to cause a decline in the latter.

Besides this, there is the looming ahead of the Budget, with its probable fresh taxation. Any addition to the income-tax, for instance, usually results in the prices of fixed-interest stocks giving way, inasmuch as the holders of such securities are tempted to sell them in order to reinvest the money in something else, though it should be more speculative, that will bring them in a corresponding rate of income, allowing for the extra addition of tax. This consideration is, of course, emphasised at the present time by the increase in costs of living. All things considered, the outlook for investment is somewhat nebulous, though experience goes to show that investors and capitalists take a surprisingly short time to settle down to new conditions when these are imposed.

The majority of movements in prices during the past week have been in the downward direction, although a fall has made no great progress in any market. At the root of the matter, there lies, of course, the natural disinclination on the part of anybody with money to utilise it in Stock Exchange channels until more light has been shed upon the situation, both financial and military. Yet it is curious to notice that there is still a shortage of shares in various directions, and of these, the most apt illustration which has come under our notice is the fact that a purchase of no more than 12 shares in a well-known cable company had the effect of putting up the price by 5s. The cable market on the whole is, however, leaning to the duller side, and small falls have occurred in Anglo-American Deferred, Eastern Extensions, Oriental Telephones, and United River Plate Telephones. The strength of the manufacturing group is well held, and the slight apprehension felt in regard to the possibility of the Treasury prohibiting new share issues is but little apparent.

Marconis have fallen back to 3⅛, and the recent buyers who gave up to 70s. for the shares on the issue of the company's law suit with the Government are probably regretting their hastiness. The subsidiaries are steady, though Marines have eased off a trifle to 2⅜.

Mexican Utilities are dull. There are small falls in the shares and bonds of the Mexico Tramways Co., and this in spite of the encouraging reports which are reaching this side in regard to the present position of affairs in the Republic. A report will be published at the end of this month on the investigations of two well-known New York bankers who have been studying the current problem at first hand in Mexico city. This should result in recommendations which are likely to be acted upon by the authorities in Mexico. The Monterey Light and Power Committee published the other day an account of its stewardship to date, and from this it is evident that Mexicans are not unwilling to do what they can to restore the credit of their country by fair and honest treatment of the utility corporations, and others of similar character. So far as the Stock Exchange is concerned, however, the various testimonies borne to the better condition of affairs which is emerging in Mexico have been entirely without effect, for prices have given way in the various markets of stocks and shares connected with the Republic.

General Electric ordinary shares have risen to 20¼, but apart from this the tendency in the manufacturing group is towards rather lower levels. India-Rubbers went back to 15¾, and Westinghouse Preference to 2 11/16. On the other hand, Babcocks are up to 3 5/16, and there has been some trifling inquiry for a few of the debenture stocks, with the result that prices stiffened to the extent of a point or so. Edison Preference have eased off to a guinea, shares changing hands at 20s. 6d. to-day, Tuesday.

In the electricity supply list, Westminsters are ⅛ down at 6¼, and this is the only movement amongst the London shares. Incidentally, it is interesting to notice from the report of the Stock Exchange just out that it cost the House £1,371 9s. 5d. for electric power, working expenses, and maintenance in respect of the year just finished, this showing a reduction of about £70 as compared with the previous 12 months. The electric railway market is heavy, Districts receding to 14, and Underground Incomes to 77½, the reason being the lack of vitality or resiliency in markets generally. The same want of spring is noticeable in rubber, armament, and other industrial sections, while the only notable activity amongst mining shares has been in a few Cornish issues that have suddenly become popular.

SHARE LIST OF ELECTRICAL COMPANIES

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price April 9, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6 9/16	—	£7 8 0
Charing Cross Ordinary ..	5	4	3⅛	—	5 14 4
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	8	3	—	5 4 4
City of London	8	8	12⅝	—	6 9 3
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅝	—	6 11 0
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅜xd	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	3	4	3¾	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	9	7⅛	—	6 6 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	— ⅛	7 2 10
Telegraphs and Telephones.	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94½	—	6 7 0
do. Def.	89/6	1½	22¼	— ⅛	6 14 10
Chile Telephone	8	8	7⅜	—	5 8 4
Cuba Sub. Ord.	6	7	9⅛	+ ¼	*7 7 4
Eastern Extension	8	8	15¼	—	*5 5 0
Eastern Tel. Ord.	8	8	153½	—	*5 4 6
Globe Tel. and T. Ord.	7	7	14¼	—	*4 13 3
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	18	13	51½	—	6 6 8
Marconi	10	15	8⅛	— ⅛	4 16 0
Oriental Telephone Ord. ..	10	10	4⅛	— 1/16	2 8 7
United R. Plate Tel.	8	8	6 13/16	— 1/16	*5 17 8
West India and Pan.	6d.	6d.	1⅜	—	*3 17 0
Western Telegraph	7	8	15¼xd	—	*5 5 0
Home Rails.					
Central London, Ord. Assented	4	4	61½	—	6 10 7
Metropolitan	1	1	20½	—	4 17 7
do. District	Nil	Nil	14	— ½	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	77½	— ½	*5 3 3
Foreign Trams, &c.	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2¾	—	
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	66	—	7 11 0
Brazil Tractions	4	4	42	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 1
British Columbia Elec. Rly. Pfce.	5	5	52½	—	9 12 1
do. do. Preferred	Nil	Nil	32½	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	58	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	35	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	33½	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	36½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 5/16	+ 1/16	4 10 4
British Aluminium Ord. ..	7	10	32/-	—	6 5 0
British Insulated Ord.	17½	20	8⅝	—	5 10 1
British Westinghouse Pref. ..	7½	7½	2 11/16	— ⅛	5 11 7
Callenders	20	20	17½	—	5 15 4
do. 5 Pref.	5	5	1	—	6 5 0
Castner-Kellner	22	20	8½	— 1/16	5 14 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1 1/16	—	6 6 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	20¼	+ ¼	4 18 9
Henley	25	25	19½	—	6 8 2
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15¾	— ⅛	*6 7 11
Telegraph Con.	20	20	42	—	*5 18 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£72	..
a Bisulphide of Carbon	,,	[illegible]	..
a Borax	,,	£38	..
a Copper Sulphate	,,	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£22 10/-	..
a Sulphate of Magnesia	per ton	£15	£1 dec.
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/-	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/7 to 1/7½	..
g ,, Bars (best selected) ..	per ton	£147	..
g ,, Sheet	,,	£147	..
g ,, Rod	,,	£147	..
d ,, (Electrolytic) Bars ..	,,	£125	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods	,,	£133	..
d ,, ,, H.C. Wire	per lb.	1/3⅞	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/8	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/1	3d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	4/2	..

Quotations supplied by—

a G. Boor & Co.	*g* James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	*h* Edward Till & Co.
d Frederick Smith & Co.	*i* Bolling & Lowe.
e F. Wiggins & Sons.	*l* Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*n* P. Ormiston & Sons.
	r W. F. Dennis & Co.

Canals Relieving Railways of Traffic.—Canals are now of greater value to the community, owing to conditions brought about by the war, than they have been at any time since railway transport deprived them of most of their traffic and revenue. The Canal Committee has now under its control 1,202 miles of waterway in England and 304 miles in Ireland. In addition, there are 1,025 miles of canals in England which, as they are owned by railway companies, are managed by the Railway Executive Committee. The financial terms on which the canals were taken over by the Government are the same as those which were allowed to the railways—the guarantee of their net revenue of 1913; but the position of canals and railways is not entirely identical. As the Government scheme of control applies only to the canal companies, it does not guarantee the profits of the canal carriers. It is expected that this drawback will soon be removed, as the Canal Control Committee has made financial recommendations to the Board of Trade for the purpose of enabling the carriers to fix rates that will divert additional traffic to the canals and pay the high wages which labour now demands.

Despite adverse circumstances the Canal Control Committee has already done much to make the canals valuable and economical agencies of transport.—*The Times.*

Dielectric Tests.—At the present time there is a notable lack of data on the dielectric constants which pertain to a large variety of substances. A description of a series-inductance bridge for measuring dielectric energy losses at low frequencies and high potential gradients is given in the *Electrical World* (Vol. 71, No. 10) by C. A. Butman, which affords a means of obtaining the information. As alternating currents are used, no trouble is caused by the dielectric after-effect, as is the case with direct currents. The bridge gives a means of determining the geometric capacity of condensers having a capacity from 1 mfd. to 0·0001 mfd., with one setting of the bridge arms, with an accuracy of about 0·01 per cent. of the capacity measured. The bridge is especially valuable in investigating anomalous dielectrics. The change of a dielectric to the state of a conductor can be traced by changing the temperature. Moreover, it is now generally recognised that a measure of the dielectric energy loss is the best single test that can be applied to insulation. In designing electrical machinery it is now necessary to take into account, besides the other losses, the dielectric energy loss. This bridge gives a means of determining this loss under the same conditions as obtain in practice.

THE MECHANICAL DESIGN AND SPECIFICATION OF THE TURBO-ALTERNATOR ROTOR.

By S. F. BARCLAY, Ph.D., B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 320).

As an alternative to the magnetic and non-magnetic end-bells, there may be considered the question of a composite end-bell. The centrifugal force of the coils varies in the axial direction, being least at the core end and a maximum at the other end. For a 25-in. diameter rotor, for which a manganese-bronze bell could not be used, it would be permissible to employ a composite bell of steel with a relatively narrow band of manganese-bronze next to the core, as shown in fig. 7. The saving in magnetisation loss with such a construction as compared with the all-steel bell may be of the order of 50 per cent. The all-steel nickel-chrome end-bell represents the preferable construction. For a given stress the manganese-bronze stretches (elastically) 47½ per cent. more than steel; for this reason the manganese-bronze ring should be registered on the steel ring, as in fig. 7, and not under it, so that it is free to open. If the bronze were registered under the steel, the projecting lip would prevent the bronze opening sufficiently (elastically) to carry its share of the load, and the lip might be overstressed. The author has heard of failures due to this obvious precaution not being taken.

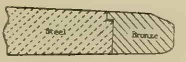


Fig. 7.—Composite End-bell for High-speed Rotor.

The usual design of end-bell is a cylinder registering on the rotor core at one end, and on a disk shrunk on to the shaft at the other. In the case of a 5,000-kw., 3,000-r.p.m. alternator the cylinder opens about 0.03 in. in diameter. It is not possible to give the cylinder sufficient initial tension by press fit to prevent it opening in this way. The tendency of the coil loading is to make the cylinder become elliptical, but since there is nothing to centre it definitely it may move bodily out of centre by the amount its opens radially. The vibration with some alternators that cannot be corrected completely is probably due to this cause in some cases. The author is very strongly in favour of making the cylinder and the end disk down to the shaft in a single piece, as shown in fig. 8; the bell is thus definitely centred and eccentricity is prevented. An additional advantage of this design is that it is not necessary to register the bell on the rotor core, and an appreciable gap can be provided between the core and the bell, so reducing the magnetic leakage. The short length of coil between the core and the bell is supported by extending the slot wedge and by registering the end of the wedge under the bell. Another advantage that may be obtained with this construction is to make the seating on the shaft larger in diameter than the slip-rings, so that the end-bells may be removed for examination or repair of the windings without interfering with the slip-rings or the connections to them. The construction also has the advantage of very considerably strengthening the cylinder at the end where it is most heavily loaded.

The various systems of ventilation that have been tried at various times have now settled down roughly to two distinct types—axial and radial. The advantages of the axial system are that the omission of the radial ducts shortens the machine, and that the rotor may be separately and positively ventilated. The disadvantage of this system is that there is an appreciable difference of temperature between the two ends of the machine. The temperature difference may be reduced somewhat by arranging the flow of air through the rotor and stator in opposite directions. With the radial system the temperature rise can be kept almost uniform from end to end, but there are the disadvantages that most useful material is removed from the rotor in forming the radial ducts, and that the rotor ventilation is not positive. The flow of air through the rotor is induced only by the natural fanning effect of the radial ducts, and the flow is opposed by the pressure in the gap set up by the fans. With larger machines the air velocity through the stator has to be made high for the necessary volume of air to flow, and pressure equal to 6 in. or 7 in. of water has to be set up by the fans. At the ends of the rotor such a pressure quite overcomes the rotor fanning effect, and the discharge from the rotor ducts must be prevented, if not actually reversed. It is probably only towards the centre of the core, where the air-gap pressure is reduced, that there is any appreciable flow of air from the rotor.

The author considers the ideal system to be that which has radial ventilation for the stator, with independent axial ventilation for the rotor, as shown in fig. 8. The air for the rotor and stator is kept quite separate, and the volume and temperature rise of it can be separately measured. By varying the rotor fan the volume of air flowing through the rotor can be regulated to give the exact volume required. The omission of the rotor axial ducts gives the designer liberty to work to the tooth density he prefers rather than that to which he may be forced. There must be some difference of temperature between the two ends of the rotor, but the volume of air can be made sufficient to keep the hotter end within the desired limit. By suitably disposing the stator ducts the temperature throughout can be kept substantially uniform. In addition, when necessary, axial ducts may be arranged in the stator, and the discharge from these into the various radial ducts may be separately varied to further equalise the temperature rise. The omission of the radial ducts reduces somewhat the noise of the alternator, and also the windage loss.

It is quite usual to see with an otherwise well-designed rotor, fans that are anything but robust in construction. Sheet steel about 1/16 in. thick for the blades, and about ⅛ in. thick or less for the runners, is frequently employed, and apparently that the fans will be satisfactory is taken for granted, and is not verified by calculation. Several cases have come to the author's notice of such fans collapsing and striking the stator end-windings, with complete breakdown of the alternator. Safety must come first, and the permissible number of blades must be determined by the maximum thickness that it is desirable to employ for the runners. The blades should be given such a thickness that collapse is impossible. For the smaller sizes oil-hardened boiler plate is satisfactory for the blades and runners, but for the larger sizes oil-treated nickel-chrome steel plates should be used.

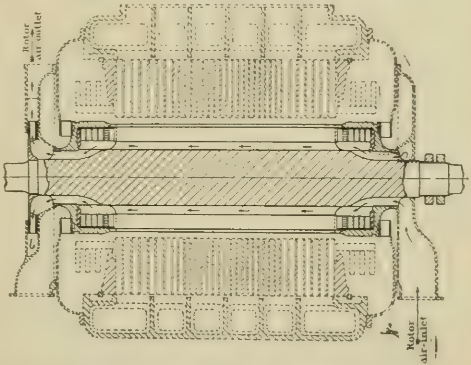


Fig. 8.—Turbo-alternator with Axially-ventilated Rotor and Radially-ventilated Stator.

The loss due to the fans in large high-speed machines is of the order of 20 per cent. of the total windage. The efficiency should be kept as high as possible, since the loss not only affects the alternator efficiency, but also adds to the heating.

With very high peripheral speeds more noise must be expected than with the lower speeds of a few years ago. The station can be made much quieter if the discharge air is led away through a duct, and for large high-speed sets it is very desirable to adopt this arrangement.

Freedom from vibration is an essential mechanical requirement. With marked vibration, wear of rubbing parts may take place at an extraordinary rate, and the soundest construction be weakened in the course of time. A press fit that would be perfectly solid in normal circumstances may become free in the presence of vibration, and relative movement of the parts may take place. Movement of the end windings is more probable, and the insulation under great pressure is very likely to suffer wear. Every component part should be so designed that change of balance is safeguarded against. The degree of balancing should be put on a positive basis by using a vibration indicator. The grooves for the balance weights should be provided in the disk supporting the bell cylinder; the practice of attaching balance weights to the outer fan runners is most unsound. Much time is saved in balancing, and the final result is often better, if the rotor is balanced statically before running. Although the correct division of the balance weights between the two ends of the rotor cannot be determined statically, the total weight required is determined, and adjustment of it only is required when making the running balance. The sensitiveness of the knife edges is much increased by resting the shaft on ball or roller races.

The stresses and pressures for a given rotor increase with the square of the speed. For proving mechanical soundness the overspeed test fails because it is fatigue failure that is most to be feared, and an increase of speed does not prove capacity to withstand fatigue. The overspeed does directly test the soundness of the rotor teeth and of the end-bells, but even its value in this way is limited, because in the event of there being a flaw, due to the ductile quality of the steel, it is more probable that failure will result after prolonged running than at the moment. A great disadvantage is that the overspeed imposes an undue stress on the insulation that is harmful. The turbine emergency governor should be set to operate at 10 per cent. overspeed, and the set should be capable of standing an overspeed of 20 per cent. At this overspeed the pressure and the centrifugal force are 44 per cent. greater than at the normal speed. The author holds the view that all parts of the rotor should be designed as if it were to run at 20 per cent. overspeed continuously. At the normal speed the stresses and pressures are 30.5 per cent. less, so that the factors of safety in the teeth and end-bells are then very satisfactory.

The author expresses his obligation to Mr. Douglas Vickers and Mr. W. Clark, directors of Messrs. Vickers, Ltd., for permission to read this paper, and his indebtedness to his colleague, Mr. J. P. Nicholson, who conducted the various mechanical tests referred to in the paper.

An appendix gives a specification of a solid forged rotor.

A LARGE HIGH-SPEED FRANCIS TURBINE.

The accompanying illustration, from an article by Arnold Pfau in *Power*, shows a 25,000-H.P. turbine recently built for the Puget Sound Traction, Light & Power Co. This set is the most powerful high-head Francis turbine in the world, and is practically a duplicate of the two 18,000-H.P. machines already in service at White River, near Sumner, Wash.

The plant has been laid out with a view of maintaining the highest economy of water, since it is combined with a large storage capacity, which furnishes the operating water during dry seasons. The course of the White River is blocked by a timber-crib dam, the water being controlled by steel gates, and led through a heavy timber flume into a forebay. An open canal leads to the storage reservoir, called Lake Tapps, which has a capacity of 2,250,000 cu. ft., equivalent to 18,000,000 KW.-hours, obtained under the net head of 440 ft. From Lake Tapps the water is carried through a deep open cut and a tunnel about 3,000 ft. long, carrying 3,000 cu. ft. of water per second. The tunnel ends in a forebay from which individual 8-ft. steel pipe lines lead down to the power house.

The variation of the commercial load of the Puget Sound traction system is sometimes very severe, and the long tunnel combined with the pipe lines, about 2,500 ft. in length each, together with the requirement of a water-saving method of speed regulation under heavy fluctuations of load over a high-tension transmission line, offered a problem which required careful study.

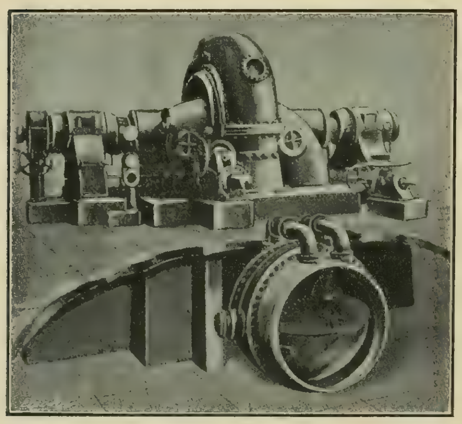


Fig. 1.—25,000-H.P. Francis Turbine.

An analysis of all precautionary methods was made, and as a result it was decided to use :—

1. A surge reservoir at the end of the tunnel to prevent surges affecting the pressure in the pipe lines and *vice versa*.

2. Pressure regulators permitting a sudden release of the water when the governor closes the gates quickly. To prevent waste these by-passes are automatically closed, stopping the flow without causing secondary pressure rises.

3. Air-cushion tanks, to supply hydraulic energy when the demand of load is so sudden that the water cannot accelerate sufficiently fast in the pipe line to prevent a drop in pressure.

The proper combination of these devices, together with a fairly liberal flywheel effect of the generators, enabled a high degree of accuracy in speed regulation to be attained. The turbines of the initial installation are of the double-discharge, horizontal-shaft, spiral-case type operating under a net head of 440 ft. at 360 R.P.M.

The water from the penstock passes through a steel butterfly valve, 7 ft. inside diameter, taking a total normal pressure on the gate of about 1,000,000 lb. The steel runner of the turbine is bolted to a flange forged solid with the shaft, and is of the double-discharge type. The shaft revolves in two ring-oiling bearings with self-aligning ball-and-socket seats, one end having a solid flange for direct coupling to the generator. The opposite end carries the mechanical hand brake, and the bearing at this end serves also as a thrust bearing; the main thrust, however, is automatically taken by means of a simple and efficient hydraulic balancing arrangement, combined with the two runner rims and the adjacent portions of the stationary cover plates. The governor has a capacity of about 50,000 ft.-lb., and is capable of moving the turbine gates over their full stroke in one second.

The turbine discharges about 450 cu. ft. of water per second, and when the flow is stopped through the turbine gates in 1.5 sec., it will discharge through the pressure regulator to its full amount by the time the governor has closed the turbine gates. Thus no serious pressure rises occur due to an abrupt change of velocity in the pipe line.

When the units were put into commercial operation, tests showed an efficiency exceeding 90 per cent., and the efficiency will still be about 80 per cent. at one-fifth load. The full load of 20,000 H.P. was thrown off suddenly, causing the governor to close the gates quickly. The speed did not rise more than 12 per cent. above normal, and the maximum pressure rise in the pipe line above normal did not exceed 5.5 per cent., as against a guaranteed pressure rise of 15 per cent., and a speed rise of 18 per cent.

After five years of continuous service one of these turbines was opened for examination. No repairs whatever were considered necessary, and it was estimated that it would be good for another five years of continuous service under similar conditions.

The results of this examination were so gratifying that it was decided to build the new third unit practically a duplicate of the first two. The rated horse-power was increased from 18,000 to 24,000 without increasing any parts except those directly affected, such as the runner, shafts, guide vanes, &c. It is expected that 25,000 H.P. will be delivered to the generator shaft, and the efficiency and speed regulation will at least be as good as they are with the first sets.

RAILWAY ELECTRIFICATION AS A MEANS OF SAVING FUEL.*

By E. W. RICE, Jun.

We are in the midst of an extraordinary coal famine. I would like to point out how much worse the situation might have been were it not for the contributions of the electrical engineer; and also how much better our condition might have been if our contributions had been more extensively utilised.

Suppose we assume that the present serious situation is due to a lack of production of coal. It is comforting to consider to what extent the output of our coal mines has been already increased by the use of electrical devices in connection with coal mining, but I think it is a fair assumption that the output of coal mines should have been increased at least 25 per cent. on the average by the employment of such electrical devices. If this estimate were cut down to 10 per cent. it would still leave a possible increase in the tonnage of coal produced of something like 50,000,000 tons during the past year.

If, on the other hand, our situation is due to the failure of the distributive agencies of the country, which is more probable, it is interesting to see how this difficulty would have been largely removed if the railroads of the country had been operated by electricity instead of steam.

Where electricity has been substituted for steam in the operation of railroads, fully 50 per cent. increase in available capacity of existing tracks and other facilities has been demonstrated. This increased capacity has been due largely to the increased reliability and capacity, under all conditions of service, of electric locomotives, thus permitting a speeding up of train schedules by some 25 per cent. under average conditions. In extremely cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing. At a time when the steam locomotive is using up all its energy by radiation from its boiler and engine into the atmosphere, the electric locomotive is operating under its most efficient conditions, and may even work at a greater load than in warm weather.

But this is not all. It is estimated that something like 150,000,000 tons of coal were consumed by the railroads in the year 1917. We know from the results obtained from such electrical operation of railroads as we already have in this country that it would be possible to save at least two-thirds of this coal if electric locomotives were substituted for the present steam locomotives. On this basis there would be a saving of over 100,000,000 tons of coal in one year. This is an amount three times as large as the total coal exported from the United States during 1917.

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* Abstract of presidential address at the Midwinter Convention of the A.I.E.E., New York City, February 15th, 1918. From the *General Electric Review*.

The carrying capacity of steam roads is also seriously restricted by the movement of coal required for haulage of the trains themselves. The useful or revenue-carrying capacity of steam roads could be increased about 10 per cent. with existing track facilities by eliminating the entire company coal movement.

The consumption of oil by the railroads amounted in 1915 to something like 40,000,000 barrels, nearly 15 per cent. of the total oil produced. This fuel is entirely too valuable to be used in a wasteful manner. It is important for many reasons that such a wonderful fuel as oil should be most economically used, if for no other reason than that it will be needed for the ships of our forthcoming merchant marine, for the tractors that till our fields, and the motor trucks that serve as feeders to our railways.

The possible use of water power should also be considered in this connection It is estimated that there is not less than 25,000,000 H.P. of water power available in the United States, and if this were developed and could be used in driving our railroads, each horse-power so used would save at least 6 lb. of coal per H.P.-hour now burned under the boilers of our steam locomotives. Potential water power is being largely lost because most of it is allowed to run to waste, undeveloped, unused. Coal is wasted for exactly the opposite reason; it is being used, but in an extravagant and inefficient manner.

It is really terrifying to realise that 25 per cent. of the total amount of coal which we are digging from the earth each year is burned to operate our railroads under such inefficient conditions that an average of at least 6 lb. of coal is required per H.P.-hour of work performed. The same amount of coal burned in a modern central-power station would produce an equivalent of three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the source of power to the locomotive.

It is not too much to say that if the roads of the country were now electrified no breakdown of our coal supply, due to failure of distribution, would exist.

We have had enough experience upon which to base a fairly accurate determination of the stupendous advantages and savings which will surely follow the general electrification of the railroads; in fact, I think we can demonstrate that there is no other way known to us by which the railroad problem facing the country can be as quickly and as cheaply solved as by electrification.

The solution of the railroad problem would also "kill two birds with one stone" by solving the fuel problem at the same time.

We would not be justified in being so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. There is no element of uncertainty, nothing experimental or problematical, which should cause us to hesitate in pressing our claims upon the attention of the country.

If a general scheme of electrification were decided upon, the natural procedure would be to electrify those portions of the steam railroads which will show the greatest results and give the greatest relief from existing congestion. Electrification of such sections of the steam railroads would have an immediate and beneficial effect upon the entire transportation system of the country.

ELECTRIC SIGNALLING AND CONTROL ON RAILWAYS.

Mr. Jacob's paper on this subject was discussed at a meeting of the Scottish Local Section of the Institution of Electrical Engineers in Edinburgh.

Mr. C. E. Cockburn (G. & S.W. Rly., Glasgow) spoke of experiments dealing with colour signalling at St. Enoch Street for the purpose of securing something which would convey the same message by night as by day. He admitted the difficulties accompanying the use of orange, and said they had got over the obstacle by adopting a simple device—a bit of cloth stretched on wire guards across a circular disk; this by day showed a bar against the circle, and at night a red bar across a white circle. The system of control through lock and block by track circuit was in operation as far back as the early 'eighties, but had to be taken out owing to the difficulty of maintaining the complete circuit. Other methods had been adopted, and while there were some who thought the introduction of an electric system was going to do everything, the matter was still largely in the experimental stage. He suggested the use of the rails for actuating the control, and while he was told that this was impossible at present, he hoped to see it accomplished.

Mr. Chewan (Edinburgh) agreed with Mr. Jacobs that the high-voltage track circuit would meet requirements, but he thought the initial outlay and maintenance cost would be so great as to prohibit its use. He suggested that instead of working on the present system they should adopt a system by which they could do away with the voltage drop and operate by the current increase in the circuit due to the train shunt coming on to the circuit. That system would be operated much on the lines adopted in the arc-lamp working with shunt and series coils, the idea being that as the current increased in the series coil it would practically neutralise the mechanical effect of the shunt coil, and by doing so drop the relay.

Mr. Donald S. Munro (Edinburgh) questioned whether the time had not come when the whole subject should be discussed on the basis of the complete electrification of the line. When main lines were fully electrical the factors of success and resources of power were wholly changed. In this connection, the devices and experiences of such lines as had already been electrified could usefully be described more fully to the Institution. The methods described by Mr. Jacobs, even with suggested improvement in the proportions of the actuating currents, seemed far too sensitive to be safely dependent upon the very fluctuating resistance of the ballast. That they had had so great a measure of success was much to the credit of the instrument makers and the men who had had charge of their operation. Direct-current devices involved the use of solenoids, make-and-break arrangements with their spring contacts and set screws, and, worst of all, they necessitated small batteries. In addition to these disadvantages, a direct-current circuit always encouraged leakage and corrosion. Reliable main-line signalling apparatus should be standardised in a form applicable to considerable distances, and in a manner guarded from fall of pressure faults, or, on the other hand, from leakage currents from neighbouring power lines. It would seem that the alternating magneto-generator, which had proved so reliable for long-distance telephones, could be applied hopefully to block signalling work. With a magneto-generator in the cabin, and with polarised coils and a rocking armature at the signal post, every rotation of the magneto was positively accompanied by a certain definite series of movements of the rocking armature. These regulated vibrations of the armature might easily be adapted to operate a ratchet escapement. The escapement through a simple mechanical relay could be applied to semaphore posts, lamps, or cab indicators. A few rotations of the armature would release the escapement till the signals stood at "clear." Twice the number of motions would indicate "caution," and thrice would signal "stop." It would not be difficult to arrange a special prolonged emergency stop signal, which could apply the train-lighting battery to a magnetic valve on the vacuum brake. It was admitted that an audible signal in the cabin was desirable, and here the magneto bell would probably work with greater certainty than a D.C. arrangement. In a main-line signal box the separate magneto-generators would be power-operated, with push buttons to control generator revolutions, while a more simple hand arrangement would serve for unimportant lines. The alternating current tended to remove moisture leakage automatically, and this was specially important under exposed railway conditions; then, by fitting condensers, they might confine the effects of possible damage by leakage from a local power circuit. Track-circuiting conditions would change when rails were bonded, and, perhaps, cross-bonded for earth return for electric traction. It might then be necessary to fit a high-resistance contre-rail contact circuit on the first and last pair of wheels of every train, with or without an automatic interruption device, in tune with the relative alarm signal in the cabin and on the locomotive. Even on existing steam lines a track circuit should show when there was no leakage current from rail to rail, *i.e.*, it should indicate a broken circuit.

In a brief reply, on behalf of the author, Mr. Wood said the question of train control must be looked at from common lines, and he had no doubt that some universal system would yet be decided upon. The introduction of the magneto in place of so many primary batteries would mean much scrapping of existing apparatus, and it was somewhat questionable if a failure could be so easily secured on the side of safety.

COAL AND PEAT SUPPLIES FOR POWER.

The Dublin Local Section of the Institution of Electrical Engineers recently considered the report of the Coal Conservation Sub-Committee on Electric Power Supply in so far as it affects Ireland.

Major O. T. O'K. Webber, R.E., who presided, said the solution of the workman's problem and that of the employer lay in the greatest possible use of power, hence the growing importance of having available an adequate and cheap supply of power produced with the greatest economy of fuel. Seaborne coal was not to be despised, as it could be landed direct into the power station at the water's edge. As to native coal in Ireland—his own experience only extended to the Leinster coal—it could only be called a somewhat refractory fuel, as it was deficient in by-products, and an adequate supply for the necessary size of station was unattainable. The super-power station held out great hopes as a means of realising the great wealth of the Irish peat deposits.

Mr. G. Marshall Harriss, manager of the Dublin United (Electric) Tramways, referred to the question of cheap power as of vast national importance; the only way in which they could keep up wages in Ireland was to increase their industries, and the only way in which they could do that was through cheap power. Great Britain would have the advantages of super-power stations to conserve its coal supply, and unless they in Ireland took steps in the same direction, no legislation that could be devised would stop their best young men from leaving the country to go where they would be better paid. It was doubtful if the Irish coal seams were big enough, or if coal could be raised in competition with England, even plus the cost of carriage across. For such a scheme as would put Ireland on a sure footing they should be assured of a supply for 100 years. He did not think their water-power was sufficient; but peat was there, and they should use every means at their command, and spare no money to see that that great resource was developed. He believed it was possible, with proper machinery, to provide peat which would be nearly as good and as cheap as coal.

Mr. Thos. Tomlinson said they had 3,000,000 acres of peat right across the centre of Ireland, which would be equal to about 3,200,000,000 tons of coal; while using this they would be uncovering 5,400 acres of first-class limestone marl. By reducing the moisture of peat by 10 per cent., a ton of peat would be nearly equal to a ton of coal.

Mr. Wm. Tatlow advocated the use of water-power for the sake of economy.

Mr. J. P. Tierney said that one of the difficulties about the utilisation of peat for power purposes was the cost of acquiring the right to work the peat deposits. In this matter they could learn from Belgium, where the State took over the bog and fixed the price of it, advancing capital at 2 per cent. to public companies, and the Government appointed a certain number of directors on the company boards. On the question of water-power, he said that what had been done in the utilisation of the water of the Mississippi for St. Louis, 150 miles away, showed that the suggested scheme for the Highlands of Donegal might possibly be worked as a complement to the Central Ireland scheme for the utilisation of peat.

Mr. J. J. Parkinson, of the Wolfhill Colliery, deprecated adverse criticism of the Irish coal deposits. The Leinster coalfield constituted 75,000 acres. At the Castlecomer end there was a 4-ft. seam extending over 5,000 or 6,000 acres, and there was a 2-ft. seam practically all over the rest of the field. He estimated that there were 150,000,000 tons of coal in the Leinster coalfield. They were now putting down plant to produce 1,000 tons a day of anthracite coal, which would probably be equal in value to 3,000 tons of bituminous coal.

Mr. L. J. Kettle, Dublin Corporation electricity department, entered a protest against the Coal Conservation Committee's suggestion that the electrical schemes should be put into the hands of private companies, and not entrusted to the management of the State or local authorities. The exceptionally-situated North of England scheme alluded to by the Committee was cheaply worked on account of its utilisation of waste heat from blast furnaces, &c. There would be great difficulty in carrying out the recommendations of the Committee in England because of the diversity of design of the various plants already in existence there. Ireland had so far very few electricity schemes, and very little industrial development. It was, in fact, a virgin country. In his opinion, it would be much easier to carry out a comprehensive scheme with a large central-power station and smaller stations on a standard plan in Ireland than in any of the highly industrialised countries; but before anything could be done, there should be a national survey of the power resources of the country, and that, he submitted, was not the business of any private individual or private company, but the business of the State as a whole. It was little credit to the responsible Government in Ireland that they had not got a single item of information in this respect to go upon. He concurred with Mr. Parkinson as to the excellence of the Wolfhill coal; the only thing was that, unfortunately, they could not get enough of it.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,191. "Ignition devices for internal-combustion engines." W. G. Ikin. March 25th

5,202. "Telephone receivers, &c." J W Hobley. March 25th.

5,208. "Electric ignition device." H. E. Partridge. March 25th.

5,216. "Electromotors." W E. Clifton. March 25th.

5,230. "Electric couplings" H. de la Valette. March 25th (France, March 28th, 1917.)

5,241. "Electric transformers." J. L. Thompson, and British Westinghouse Electric & Manufacturing Co. March 25th.

5,245. "Electric heating devices for hatching, bacteriological, &c., apparatus." Sir C. S. Forbes. March 25th.

5,265. "Electrical switchboards." T. Masson. March 26th

5,286. "Electric motors." W. F. Higgs. March 26th.

5,314. "Systems of electrical distribution." A. Crooke & T. Thompson. March 26th.

5,322. "Circuit breakers." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 26th

5,323. "Lampholders for incandescent electric lamps." C. L. D. Delanne. March 26th (France, March 19th, 1917

5,329. "Electrical heating apparatus." C. Sorensen. March 26th

5,342. "Apparatus for electrically treating soil for agricultural purposes, &c." F H Hall. March 27th.

5,353. "Method of carrying and springing accumulators on motor cycles and motors cars." R. Gamblin March 27th.

5,354. "Electric ladle." E. Lewis. March 27th.

5,381. "Automatic telephone systems." Automatic Electric Co. & Automatic Telephone Manufacturing Co. March 27th.

5,395. "Electric arc lamps." H. B Grylls & W. Heale. March 27th

5,404. "Means for obtaining high-tension direct-current voltages." F. E. Berry. March 27th.

5,410. "Method of producing showers, &c., of electric sparks for advertisement purposes." O. Tange. March 27th.

5,420. "Auto-generating portable electric lamp." V. Filippone. March 27th.

5,421. "Interlocking mechanism for electric switches, &c." C. J Baker and V. G. Middleton. March 27th.

5,423. "Searchlights, &c." E. A. Sperry. March 27th. (U.S.A., March 27th, 1917.)

5,476. "Telephone systems." Automatic Telephone Manufacturing Co., A. J. Ray & J. Savin. March 28th.

5,477. "Telephone systems." Automatic Telephone Manufacturing Co., A. J. Ray & J. Savin. March 28th.

5,478. "Telephone systems." Automatic Telephone Manufacturing Co. and A. J. Ray. March 28th.

5,479. "Apparatus for electrolysing salt solution." T. Matsushima. March 28th. (Japan, March 30th, 1917.)

5,504. "Means for cleansing sparking plugs of internal-combustion engines, &c." G. J. Scott. March 28th.

5,560. "Switches." H. Lucas & W. C. Turner. March 30th.

5,561. "Ignition apparatus for internal-combustion engines." H. Lucas. March 30th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1917.

264. System and Means for Electric Ignition of Gas, Petrol, and like Internal-combustion Engines. W. S. Frost. January 5th, 1917. (113,799.)

1,082. Variable-speed Generators and Storage Battery Systems. H. A. Gill (U.S. Light & Heat Corporation). December 5th, 1916. (Divided application on 17,452/16.) (113,258.)

1,729. System of and Apparatus for Wiring Ships, Buildings, and the like for the Distribution of Electricity. L. M. Waterhouse. February 3rd, 1917. (113,800.)

1,763. Electric Contact-making Device especially adapted for use in Ignition Systems. J. Y. Johnson (N. Mellor). February 3rd, 1917. (113,802.)

3,113. Manufacture of Carbon for Electrochemical, Metallurgical, and other Services. T. W. S. Hutchines. March 2nd, 1917. (113,812.)

3,318. Control and Regulation of Electric Furnaces. Brown, Boveri and Co. & A. Gray. March 6th, 1917. (113,827.)

3,422. Method of and Apparatus for Welding of Sintering Tungsten Ingots and the like. M. J. Insull. March 8th, 1917. (113,835.)

3,425. Electrical Contacts. M. J. Insull. March 8th, 1917. (113,838.)

3,426. Electric Furnaces. M. J. Insull. March 8th, 1917. (113,839.)

3,748. Overhead Equipment of Electric Tramways. J. Duggan. March 15th, 1917. (113,850.)

3,874. Tubular Demountable Resistance Units for Rheostats. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 16th, 1917. (113,854.)

4,116. Means for Coupling a Magneto-generator with an Internal-combustion Engine. D. Y. Wheatley. March 21st, 1917. (113,859.)

4,556. Engine Starter. V. Bendix. March 20th, 1917. (113,527.)

4,580. Windings for Electric Transformers and similar apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 29th, 1917. (113,356.)

4,720. Automatic Device for Wireless Signalling. J. Morrison & W. A. Morrison. April 24th, 1917. (113,532.)

5,151. Electric Welding Apparatus. W. H. Isherwood & W. H. Turner. April 12th, 1917. (113,537.)

5,305. Insulating Devices for the Live Rails of Electric Railways. W. E. Windsor-Richards & E. T. Brooks. April 14th, 1917. (113,362.)

6,437. Micro-telephones for use in Automatic Exchange Systems. H. Symes. June 26th, 1916. (108,463.)

6,298. Sparking Plugs. T. E. Ponset. June 26th, 1916. (108,461.)

6,699. Lead-covered Cables. British Insulated & Helsby Cables, Ltd., and R. W. Blades. May 11th, 1917. (113,378.)

6,700. Lead-covered Cables. British Insulated & Helsby Cables, Ltd., and R. W. Blades. May 11th, 1917. (113,379.)

6,725. Protection of Electric Distribution Systems. P. V. Hunter, J. R. Beard & Electrical Improvements, Ltd. May 11th, 1917. (113,380.)

7,442. Method and Means for Electrically Welding and Shaping the rims of Wheel Tires. R. Kronenberg. May 23rd, 1917. (113,882.)

7,820. Miners' Safety Lamps. R. Lambourne. May 31st, 1917. (113,386.)

8,814. Means for Adjusting Electric and Gas Lamps. G. E. Etlinger. June 19th, 1917. (113,391.)

9,014. Electric Transformers, especially suitable for use in connection with Electric Furnaces. J. Bibby. June 22nd, 1917. (113,899.)

9,404. Interrupting Devices for the Electric Ignition of Internal-combustion Engines. O. Imray (R. Bosch). June 29th, 1917. (113,220.)

9,496. Trolley Heads of Electric Tramcars and the like. A. Harwood and F. H. Bennett. July 3rd, 1917. (113,901.)

9,784. Telephones. E. A. Petithory. July 6th, 1917. (113,565.)

10,052. Electric Switch. W. S. Shephard. July 12th, 1917. (113,905.)

10,242. Rotary Electric Switches. A. A. Buck. July 16th, 1917. (113,400.)

10,379. Method of and Arrangements for Extracting Zinc by the Electro-thermal Process. E. S. Berglund. September 5th, 1916. (109,435.)

10,636. Condensers for Ignition Magnetos. E. A. Watson & M-L Magneto Syndicate. July 24th, 1917. (113,910.)

10,832. Telephone Transmitter. W. Birrell, J. Birrell & R. A. Cavenaugh. July 27th, 1917. (113,912.)

11,357. Magnetic Blocks for Holding Pieces of Iron or Steel during Grinding, Planing, and the like Operations. G. Khisanachoili. August 7th, 1917. (113,568.)

12,290. Apparatus for Ignition in Explosion Engines. J. H. Stringham. August 27th, 1917. (113,231.)

12,724. Electro-pneumatic Braking Systems. W. V. Turner. March 29th, 1917. (113,235.)

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LEAD AND COPPER FROM ENEMY CENTRAL STATIONS.

FROM the very commencement of the war the enemy has controlled the use of lead and copper, and requisitioned articles made of these metals, with a systematic thoroughness which proved very satisfactory in its results—as judged from the enemy standpoint. From a review of the affairs of the Vienna municipal electricity undertaking during the year 1915-16, published recently in *Elektrotechnik u. Maschinenbau*, it is evident that the policy of control and requisition was put into practice very effectively. By one means or another hundreds of tons of copper and lead were "released" for military purposes by the Vienna undertaking alone, and if the measures by which they were secured appear a trifle heroic, there is no doubt that the enemy at that date was justified in considering them cheaply won.

A great deal of copper and lead was released by the Vienna electricity department taking over the plant of the Allgemeine Oesterreichische Elektrizitatswerke and connecting up its network so as to eliminate much of the old equipment. Large quantities of these metals are said to have been handed over to the military during the year 1914-15, and the total for 1915-16 seems to have been about 500 tons of copper and 1,000 tons of lead.

Accumulators were removed from a number of sub-stations and handed over to the Akkumulatorenfabriks A.G. for military purposes, on the understanding that this company would supply replacement batteries within a year from the conclusion of peace. By this means alone about 410 tons of lead and plate materials were handed over to the military authorities. Batteries were removed from the Kaunitzgasse, Landstrasse, Mariahilf, Cobdengasse, and other sub-stations; for example, a 298-cell buffer battery of 814-ampere-hour capacity was removed from the Mariahilf sub-station. It was not, however, simply a case of depleting installations. In several instances plant was moved from one part of the system to another point where it could be employed more usefully, and in the aggregate a large amount of new plant was installed in the course of the technical development of the system as a whole, and to deal with increases in the load. A 290-cell lighting battery of 4,526-amp.-hour capacity was removed from the Kaunitzgasse sub-station during 1915-16, but it was then necessary to take into service the hitherto unused battery VII (294 type-J288 cells of 7,776-amp.-hour capacity) in order to deal with last winter's load; this battery is the largest yet in use in Austria-Hungary.

Some of the old A.O.E.G. cables were rendered superfluous by changes in the Alsergrund sub-station, and the old cable between the Neubadgasse sub-station and the Ober Donaustrasse steam generating station was withdrawn from service, as well as several heavy feeders. The lead and copper from these cables were handed over to the military. A new 1,000-KW. converter sub-station erected at Vosendorf to supply the Inzersdorf-Vienna Railway was provided with iron bus-bars and distributors.

The cable network was extended only in so far as necessitated by urgent new connections (mostly for military or munition purposes). About 58 installations in stations on the Vienna Stadtbahn were changed on to the municipal mains, and by the end of 1916 490 tons of copper and 330 tons of lead had thus been recovered from disused cables and machinery formerly operated by the State Electricity Works, Heiligenstadt.

Some idea of the strictness of the control exercised over copper supplies may be gathered from the history of the D.C. interconnecting cable formerly used between the Ober Donaustrasse station and the Neubadgasse sub-station. When this cable was rendered unnecessary by the installation of a 3-phase D.C. converter in the sub-station, the military authorities agreed that part of the copper in the cable should be used to make three lines for the Ebenfurth-Vienna high-tension overhead transmission. The original cable was of 1,000 sq. mm. section, whereas the new conductors had to be only 50 sq. mm. in section. The old cable was therefore cut into lengths of 100 metres, and the armouring, lead sheathing, and insulation were removed. The 36 copper wires thus bared were separated, stretched, cleaned, and wound in coils containing 100 metres each. Finally, the wires were drawn down from 6 mm. to 2.1 mm. diameter, and stranded together in Siemens & Halske's cable works at Leopoldau. The copper thus used is still practically on war service owing to the importance of the Ebenfurth-Vienna transmission. The total weight of copper in the duplicate 3-phase line is about 125 tons.

Owing to the abandonment of underground supply for the tramways, a considerable number of arc lamp-posts had to be replaced by stronger ones, suitable for carrying the new overhead supply.

The 16,000-volt overland network was extended considerably during 1915-16, and agreements were concluded with the municipalities of Baden and Pottendorf under which the latter will henceforth take energy from the Vienna network. Their own generating equipments will be dismantled (if this has not been done already), and further large quantities of copper and lead will thus be liberated. In order to connect to the Baden network, the Ebenfurth-Enzesfeld overhead line had to be extended about 7½ miles to Leesdorf, where a change-over station is provided from which underground cables run to the Baden station. After the war a second cable is to run to the present generating station of the Vienna-Baden Railway, which will then take all its energy from the overland system. As soon as the Enzesfeld-Leesdorf line is finished, the Voslau network will be connected to it, thus liberating more copper and lead.

Despite the war, the Vienna electricity undertaking made good progress during 1915-16, and very considerable power demands will be met directly conditions become normal. Labour difficulties have been partially overcome by the use of interned aliens; and by putting into force successive items in a comprehensive scheme of reorganisation and linking-up, the capacity and efficiency of the undertaking has been improved, whilst the quantity of material employed (particularly copper and lead) has been reduced.

The Wire-Drawing Industries.

The leading American wire manufacturing firms have for a long time past been making great preparations for the enormous trade confidently anticipated when the war is over. Two of the largest wire manufacturing firms in the United States have increased their rolling plant by over 100 per cent. during the last two years, more with a view to future expansion than to immediate requirements. Other firms have increased their productive capacity all round to an extent far in excess of any previous expansion. The American firms expect to be more favourably placed, as regards supplies of raw materials, shipping, and finance, than any of the chief copper wire producing countries throughout the world. The extent of the war's duration will determine, in a large measure, how far this position will remain as originally anticipated. A protracted duration of the war, while greatly reinforcing their financial resources, will probably seriously interrupt the normal trade organisation in much the same manner as in Great Britain and other competing countries. America may be the chief source of foreign competition after the war. The extent to which the American firms will be able to export copper wire, &c., into this country will depend more upon the weight of their own home demands than upon shipping shortage, and other expected difficulties. Should the American firms be better placed than the British firms, as regards production and supplies, the surplus over their own home demands will probably be directed to this country.

Asynchronous Generators.

Elsewhere in this issue we give a *résumé* of Dr. Kapp's important contribution to the discussion, at a meeting of the Birmingham Local Section of the I.E.E., on Mr. Wedmore's paper, which we were obliged to hold over when reporting the remarks of other speakers. We regard it as important not merely on technical grounds, but also because it illustrates the fact, so often lost sight of, that there are more ways than one of tackling a knotty problem; the discussions had turned mainly on the details of this valuable paper, but Dr. Kapp struck out on independent and totally unexpected lines, and showed that the problem of controlling large amounts of power—which had been regarded almost entirely as the problem of interrupting enormous values of kilovolt-amperes—might be circumvented by preventing the generation of large currents at high pressures on the occurrence of a short circuit. For this purpose he suggested the employment of asynchronous generators of a novel type, generating a leading current, and excited by alternating current, the general construction of the machines being otherwise much the same as that of synchronous generators of ordinary type. Such machines were to constitute three-quarters of the generating plant, the remainder being composed of synchronous alternators, which would provide the necessary control without which the asynchronous machines could not be used as generators. Only the synchronous machines would require synchronising when put on load, and protection by means of circuit-breakers and reactance coils, thus materially reducing the amount of switchgear required, as well as the number of links in the chain of apparatus. The phase advancer devised by the speaker formed an essential factor in the scheme, by compensating for the low power factor of the generators, but as a phase advancer of 78 K.V.A. suffices for a generator of 12,000 KW., this is not a serious consideration. Apparently there would not be much to choose between the old system and that outlined by Dr. Kapp in point of capital cost, but the latter scheme possesses so many advantages in other ways that it at least deserves careful consideration. And if one alternative exists to the very costly and admittedly fallible protection afforded by heavy switchgear and reactances against the consequences of a short circuit, may there not be others? The Institution is certainly indebted to Dr. Kapp for a stimulating and awakening impulse, an excellent example of the value of original and unprejudiced thinking which, if it do no more, should at least spur on others to examine the new problems which confront us with open minds and the broadest views.

A 35-TON WAGON HOIST FOR STEEL WORKS.

The North-Eastern Steel Co. have recently put on duty at their Acklam Works, Middlesbrough, an installation of electrically-driven hoisting machinery for the handling of wagons up to 35 tons gross.

The hoist was formerly operated on the hydraulic principle; in order to avoid the stoppage of work, a new steel hoist structure, with motor house on top, was built against the old structure, so that handling of the wagons was not interfered with during the installing of the new electrical hoisting plant and new wagon table. Fig. 1 shows a view of the new structure, the height of which is 60 ft. from rail to rail.

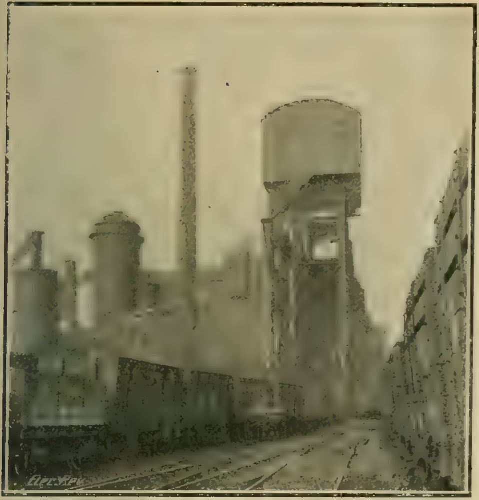


Fig. 1.—35-Ton Wagon-Hoist and Motor House.

The hoist is of the usual table type, with four sets of direct-connected corner hoisting ropes in parallel, which arrangement enables the winding drum diameter to be kept within very reasonable limits, as the drum diameter must vary directly with the rope diameter. The wagons are lowered to ground level at the far end of the store bin platform by means of a gravity hoist, as is the usual custom. In order to equalise the cycle of operations of the hoist, a tank type of counterweight is suspended by means of two pairs of ropes from the winding drums, and is so adjusted as regards its weight that the unbalanced load actually hoisted is similar on the average to the net load being hoisted as the table descends on the return or empty journey. The out-of-balance load either up or down should be equal in weight to half that of the loaded wagon, and the counterbalance weight should be equal to the table and half the loaded wagon. In practice a certain amount of variation in the load to be lifted is always met with, and the weight is so arranged as to average out correctly over a number of winds.

The two winding drums are 6 ft. in diameter, and are spirally grooved to take the four pairs of winding ropes and also the two pairs of balance weight ropes. The guide pulleys which spread the two pairs of ropes to the distant side of the platform are of an improved type, and consist of drums of a diameter equal to the main drums (instead of sheaves as are usually employed), and they in addition are spirally grooved on the rope treads. This arrangement makes an ideal guide for the rope, and eliminates all "angling" of the rope on the horizontal and almost all of the less material "angling" in the vertical planes.

The drive from the motor shaft is taken through double reduction gear, a countershaft carrying the two pinions of the second train running across the front of the drums. The gear wheels are of cast-steel, the pinions of wrought-steel, and the teeth are machine-cut double helical, in both trains, a very ample width of face and strength of teeth being provided for at the same time. The result is that noise and vibration are altogether absent during the working of the hoist.

A very important requirement in a wagon hoist is that the table must stop precisely at the rail level, both at the top platform, and also at the lower loading level, and this accuracy must be maintained under all conditions of wind, *i.e.*, with light wagons, and also when hoisting wagons loaded up to their full specified weight, in this case 35 tons. To meet these conditions a Ward-Leonard type of electrical equipment, combined with a carefully designed electrically-controlled brake, has no superior, and it has, therefore, been applied in this instance.

For the supply of energy to the hoisting motor, a motor-generator set, consisting of a 250-volt, 775-r.p.m., shunt-wound motor, the generator, and an exciter, is mounted as one unit on a substantial self-contained cast-iron bedplate. Two switchboard panels, carrying the usual switchgear and instruments, are situated in the motor house for the control of the a.c. and d.c. sides of the equipment.

The winding motor is a robustly constructed machine of 175 b.h.p. continuous rating, running at a speed of 150 r.p.m., and mounted on a heavy cast all-round bedplate, with the main shaft and pinion extension shaft carried in a low-set heavy pedestal bearing, and a large flexible coupling is fitted connecting the two shafts. A specially large and powerful type of brake is built in integral with the bed of the machine, which has been moulded with bosses and facings to receive the brake parts. The brake is weight-applied, the weight being lifted by means of a solenoid connected to the automatic controller, so that the timing of the application of the brake is accurate in relation to the travel of the hoist during deceleration, thus ensuring dead level decking of the table. The hoisting time is somewhat under 60 seconds for the 60 ft. between levels, so that the average speed is about 1 ft. per second, and acceleration and deceleration are accomplished smoothly, without shock or jar. Although the moving masses are great in hoists of this type, nearly 2,000,000 kg., when referred to the drum diameter in this case, the accelerating

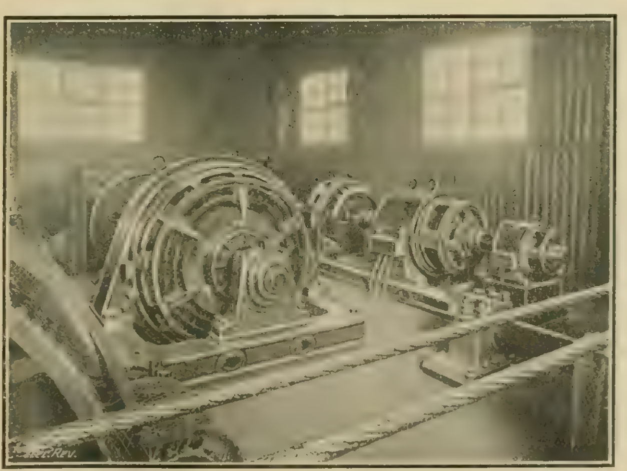


Fig. 2.—Hoist Motor and Motor Generator.

torque, owing to the low velocity, amounts to an equivalent of only a fraction of the static torque, and, consequently, should the driving torque be suddenly removed when working, the moving parts would come to a stop, and reverse by gravity within less than one second's time. It is therefore necessary to maintain somewhat less than full load torque until the end of each wind, when the brake finally determines the exact stopping point, the forward torque being removed at the same moment as the brake takes over the duty of holding the load. Fig. 4 illustrates this point clearly. It is generally found convenient, for mechanical reasons, to extend the retarding period, and also the accelerating period, to about four or five seconds, which is the time requisite automatically to move the controller rheostat the distance necessary to increase or decrease the motor torque to the required figure. If the time or distance from the end of the travel at which the power could be cut off to enable the hoist to run to rest at a correct level were the only consideration, then such an interval (0·82 sec. in the adjoining curve) would be found extremely small. Still, no shock would result, as the rate of retardation would be slightly over 1 ft. per second, and higher rates are common with other types of hoists; for the above reasons, however, the time is generally extended as stated.

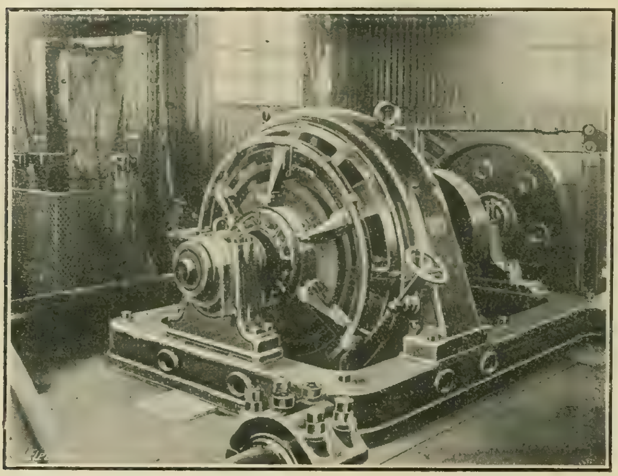


Fig. 3.—Hoist Motor and Friction-Driven Limit Switch on Column to Left.

The automatic controller, which is of a type specially developed for this class of work, is motor-operated as regards the movement of the rheostat fingers and switches required during acceleration, the motor being started by means of a master switch which is under the control of the operator by means of hand levers placed at both top and bottom levels. The deceleration and stopping of the hoist is automatically accomplished by means of two sets of racks and pinions operated by the upward movement of the table or counterweight. This gear restores the rheostat through the medium of quick-pitch screwed spindles and travelling nuts to the neutral "off" position. Overwind limit-switches are fitted, so that in the event of an overwind, from whatever cause, the hoist is brought to a standstill and the power shut off. The type of limit-switch employed on this installation does not depend for re-setting (as is the case with most designs) on the reverse movement of the hoist, but it is always capable of dealing with repeated overwinds should these occur through carelessness or flurry when re-starting the hoist. Should the necessity arise, the hoist may be brought to a stand-still by means of push-button trip-switches, which are mounted together with a set of drivers' indicating instruments in cast-iron watertight cases situated on the upper and lower levels.

The British Westinghouse Co. is responsible for the electrical equipment throughout, and the North-Eastern Co.'s engineers have carried out the design and equipment of the mechanical parts of the hoist.

THE WAR AND CHARGES FOR ELECTRICITY.

[By our Legal Contributor.]

As the war drags its weary length along, the questions which trouble the minds of those who are responsible for the management of electric lighting undertakings do not tend to become simpler. The whole situation of the electricity market has undergone profound alteration since August, 1914. In some areas the demand for energy has been greatly reduced owing to the lighting restrictions. From other areas consumers have fled in large numbers to what they consider to be regions of greater safety; while some undertakers have actually experienced an increase in the demand for electricity—an increase due to the influx of new private consumers, or to the establishment of munition factories. Indeed, it is an open secret that some of this more fortunate class of undertakers have actually paid excess profits duty.

Increased cost of production, however, is a kind of common denominator all over the country. This increase is often shared with the consumer, either with his assent or by undertakers exercising the lawful rights conferred upon them by their provisional order.

If before the war the cost per unit was well within the statutory limit, there is now no difficulty in raising the charge to consumers.

But suppose, for the sake of example, that the limit has been reached, have the undertakers any remedy? Again, suppose that by an agreement made before the war the undertakers became bound to supply all consumers at a certain fixed rate for a given number of years, is there any procedure by which they can obtain relief owing to the increased cost of production?

The following question was recently addressed to the Editors of the Electrical Review:—

"A supply company, on commencing operations, obtained wayleaves in a town for mains, &c., free of charge, on condition that for 10 years the maximum price of energy did not exceed 6d. per B. of T. unit. After 10 years a revision could be asked for either by the company or the Corporation concerned, the amount to be settled by arbitration. The company have now been in operation 14 years, but have been very hard hit by the war. They want to impose an increase to cover war costs. The question is—Can they do so? either with or without recourse to arbitration."

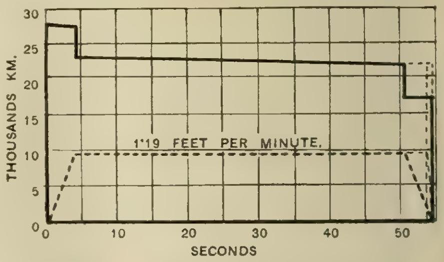


Fig. 4.—Torque-Time Diameter Curve.

In view of the terms of this agreement, which provide for arbitration after the period of ten years, it is apprehended that arbitration is a condition precedent to any change in the price. The wayleaves were granted on those terms, and if the undertakers had not been willing to forgo such statutory or other rights as they may have had in connection with the price of electricity, they would never have secured the wayleaves. The statutory right is very clear and precise. By Sec. 32 (1) of the Electric Lighting Clauses Act, 1899 (which it may be assumed applies to the area in question), the price must not exceed the figure mentioned in the Order; but by Sub.-Sec. (2), where the local authority are not the undertakers, the undertakers (or the consumers) may at any time after the expiration of *five* years after the commencement of the Special Order make a representation to the Board of Trade that the prices or methods of charge stated in the Special Order or approved by the Board of Trade ought to be altered, and "the Board of Trade, after such inquiry as they may think fit, may make an Order varying the prices or methods of charge. . . ." The "five" years was substituted for "seven" by the Electric Lighting Act, 1909.

Having regard to the express provisions of the agreement under consideration, it does not appear that the undertakers in the case referred to could insist upon a Board of Trade reference. They must rely on the agreement.

The further question then arises: Would the Arbitrator be bound, or could he be compelled, to take the conditions brought about by the war into account when fixing the new price? On the one hand, it might be said that war was not in the contemplation of the parties, and that circumstances brought about by the war could not be regarded by the Arbitrator; but the better opinion seems to be that when they provided for revision after ten years the parties contemplated a change of circumstances. The cost of production might have gone down to such an extent as to cause the consumers to apply for revision. In the case suggested, therefore, it appears that the Arbitrator might take the war into account.

The same considerations appear to apply to the larger question—namely, can the Board of Trade when revising prices in accordance with powers conferred by the Act have regard to the increased cost of production brought about by the war? The discretion of the Arbitrator appears to be in no way fettered; he may, at the instance of consumers, diminish the price if he is so minded. Wholly apart, then, from any special legislation it seems that by application to the Board of Trade undertakers may obtain a measure of relief.

But the special legislation which has come into being since the war must not be left out of account. In particular, the Courts (Emergency Powers) Act, 1917, is of importance in this connection. Its provisions appear to give some relief, which is apparently additional to, and not in substitution for, that which the Board of Trade can give. By Sec. (1) (2) of the Act, where the Court is satisfied that "owing to any restriction, or direction, imposed or given by, or in pursuance of, any enactment relating to the Defence of the Realm, or any regulation made thereunder, or owing to the acquisition or use by, or on behalf of, the Crown, for the purposes of the present war, of any ship or other property, any term of the contract cannot be enforced without serious hardship," relief may be granted.

It is important to notice that the section only applies to cases of hardship caused by (*a*) the operation of the Defence of the Realm regulations, or (*b*) the acquisition of property by the Crown, and it is made to apply specially to any obligation relating to the supply of (*inter alia*) "heat, light, traction or power arising under any Act of Parliament."

After considering the circumstances of the case, and the position of the parties to the contract, and any offer which may have been made by any party for the variation of the contract, the Court may (in the case of a contract for light, &c.) suspend the contract, or stay any proceedings for the enforcement of the contract, or any term thereof, or any rights arising thereunder, on such conditions (if any) as the Court may think fit.

It is to be observed that an ordinary contract may be "annulled or suspended," while a statutory contract for light, &c., can only be "suspended."

Assuming it could be shown by a supply company that the ordinary consumer's contract, owing (say) to some Defence of the Realm regulation, could not be enforced without serious hardship to the company, it is not very easy to define the exact powers of the Court. No power to vary the terms of the contract is given. A Judge could not say:—"You may increase your price to 10d. a unit." But if the consumer, realising that owing to difficulty in obtaining coal, the company were unable to supply on the statutory terms, were willing to pay 10d. "during the war," it is apprehended that the Court might then suspend the statutory contract for the named period.

No case has as yet been reported in which the scope of the Section has been discussed. How far does it extend? Regulations made pursuant to the Defence of the Realm Acts are of far-reaching effect. Anything which affects the supply of fuel or labour must, in the long run, affect the cost of production; but it remains to be seen whether the Judges will so construe the Section that increased cost of production, unless clearly shown to be due to some specific regulation, will afford any ground for relief.

EXTENSIONS AT AYLESBURY.

We recently had the pleasure of being present at the official inspection of the new plant installed at the borough electricity works, Aylesbury.

This undertaking was opened on May 27th, 1915, the capital cost being £21,000; for the first year, ending March 31st, 1916, the units sold were 237,963, and the revenue was £2,377, the works cost being £1,087. For the two following years, 1917 and 1918, the output was 379,794 units and 415,204 units, with revenues of £3,606 and £4,148 respectively, the works costs being £2,076 and £2,456. It is estimated that for next year the units generated will be 655,000, with the works costs at £2,900 and a revenue of £5,241. The original plant consisted of two 100-kw. Willans-Diesel engines, direct-coupled to E.C.C. generators. In 1916 it was found necessary to put down extra plant to cope with the growing load, and, after much discussion, the decision ultimately settled upon a 200-kw., four-cylinder, horizontal Premier suction gas

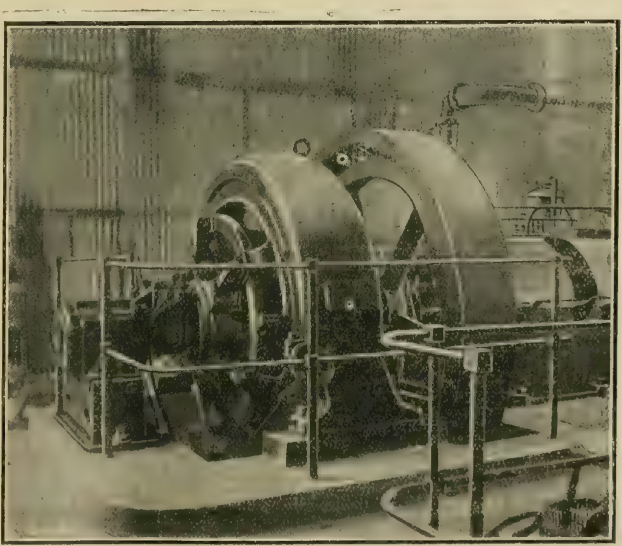


Fig. 1.—200-kw. G.E.C. Generator, with Static Balancer.

engine, running off a Power Gas Corporation's gas plant, and direct-coupled to a G.E.C. generator with static balancer, running at 210 R.P.M., 240-280 volts, 415-455 amperes.

By means of a conveniently placed electrical pyrometer the temperature of the exhaust gases from the four cylinders is measured, and, in addition to a quantitative analysis testing set, a Sarco recording calorimeter is installed, which continuously records the calorific value of the gas, which is delivered to the engine under a 2-in. pressure of water, by means of a combined exhaust and tar extractor. The engine is started by means of compressed air obtained from an electric compressor.

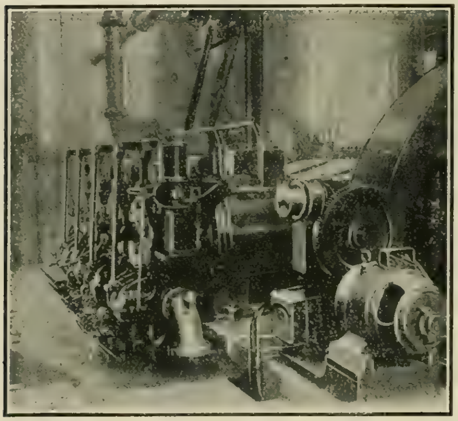


Fig. 2.—4-cylinder Horizontal Premier Gas Engine.

Due to the abnormal rise in the price of American crude oil, the experiment of running the Diesel engines on tar oil was carried out with success in August, 1916, since when a saving of £996 on fuel has been effected, equivalent to 60 per cent. on the fuel bill. The fuel cost of the new gas engine which was put into commission at the end of January works out at 0·29d. per unit generated, and a saving of £750 is estimated for next year over tar oil running.

THE CONTROL OF LARGE AMOUNTS OF POWER.

Dr. G. Kapp on the Use of Asynchronous Generators.

In the discussion on Mr. E. B. Wedmore's paper on this subject at the meeting of the Birmingham Local Section of the Institution of Electrical Engineers, Dr. Kapp said the paper dealt mainly with protection by reactances, and, as far as cables and consuming devices were concerned, this kind of protection appeared to be the only one available. The liberal sprinkling of reactances all over the system would lower the power factor; there was no help for this, but the question arose whether they were also obliged to have reactances in the generating station, thus making the power factor still worse. Need they employ synchronous machinery exclusively? They must have some such machinery to fix voltage and frequency, but they need only supply a small part of the total power output. If the bulk of it were supplied by asynchronous generators, the use of reactance coils cum extra heavy circuit-breakers would be restricted to this small synchronous part of the generating plant, whilst the big plant, consisting of asynchronous machinery, needed no reactances nor switches rated higher than the normal K.V.A. This was rather an important point, seeing that the author recommended duplicating the automatic circuit breakers on important circuits. Let an asynchronous and a synchronous machine be coupled in parallel, and assume that the asynchronous machine was rigidly connected to the bus-bars, and that there was no means of switching it off. In the case of a partial or dead short, the first thing that would happen was a lowering of the voltage. If the accident was a dead short on the bus-bars, the voltage would vanish, the circuit breaker would come out, and if the reactance of the synchronous machine was sufficiently large, the circuit breaker itself would not be damaged. If the fault had occurred somewhere outside of the station, the reactance in the particular feeder would prevent the voltage at the bus-bars from dropping to zero, but there would be some reduced voltage because the reactance of the synchronous generator would come into action, though its circuit-breaker need not necessarily come out. The asynchronous machine derived its excitation from the bus-bars, and its terminal voltage could not exceed that of the bus-bars. Neither could it give an excessive current if the governor held the engine sufficiently near the normal speed to prevent the generator from breaking step. Roughly, if the governor allowed the engine to speed up till the slip was quadrupled, the current would be doubled, and the E.M.F. halved, so that the circuit-breaker would have to deal with about normal K.V.A. If the governor failed also, then the engine would race, and the full load would be thrown on the synchronous machine, and its circuit-breaker must come out. Thus the protection given to the synchronous machine was also an efficient protection for the asynchronous machine coupled in parallel with it. Asynchronous machines had been used in generating stations. There was, however, a difficulty if they used such a machine without some device for improving its power factor. Even if it were possible to make the induction generator with so little leakage that its power factor were practically unity (this was not possible, but a power factor well over 0.9 was possible with large generators at turbo speeds), they could not use such a machine without throwing an enormous wattless current on to the synchronous generator coupled in parallel with it. This was probably the reason why asynchronous machines were not more frequently used. They had advantages. They were lighter, and required no synchronising, thus reducing complication in switchgear. But as long as they used induction generators constructed on ordinary lines their defects as regarded power factor far outweighed these advantages. The aspect of the whole question immediately changed if they got away from the ordinary lines of construction. This meant that they must so design the generator that it gave a leading current, of which the wattless component was not only that required by the external circuit, but also contained the magnetising current required by the machine itself. The internal power factor of the machine must, therefore, be smaller than the external, and the current must lead. Instead of a rotor excited by C.C. they had a rotor of the same (and possibly slightly less) dimensions, but excited by A.C. of slip frequency. The stator need not be altered, except that the deep slots which the author recommended in order to get "inherent reactance" might be made a little less deep, thus reducing the outside diameter of the stator frame. He had doubted the possibility of a satisfactory design until he began to calculate. Then it became clear that the problem was by no means difficult, and that an induction generator to fill such a specification was certainly not more costly, and might even be lighter and less costly, than a synchronous generator of the same output. As a point of departure he had taken a 12,000-KW., 3-phase alternator given by Prof. Miles Walker in his classic book on machine design. He retained the stator, and simply replaced the C.C. excitation of the rotor by A.C. excitation, with the appropriate change in winding. The air-gap was 3 mm. The following table contained some of the results of the comparative design:—

Generator for 12,000 kw.

1,500 R.P.M., 11,000 line volts, 50 cycles, $\cos \phi = 0.8$.

	Synchronous.	Asynchronous.
Slip	0 p.c.	0.5 p.c.
Slip-ring current, amps. ...	710	660
E.M.F. between slip-rings ...	150	68
Exciting power used in rotor, KW.	106	40
Weight of exciting copper, kg.	2,450	1,650
K.V.A. of phase advancer ...	—	78
Loss in phase advancer, KW. ...	—	9

The last line referred to the particular type of phase advancer known as the vibrator. It would be noticed that the slip was extremely small, notwithstanding the fact that the amount of rotor copper was appreciably less than in the synchronous machine. Apart from the saving in cost, there was the incidental advantage that the centrifugal force on the end caps was reduced by reason of the reduced copper weight of the winding. The open-circuit slip-ring voltage was 16,000. This might be thought an inadmissibly high figure, yet it was quite safe. A generator was started by its engine, and only switched on when at speed; then there was very little slip, and the slip-ring voltage was enormously reduced. The only point to be considered was how close the engine must govern, so that the slip-ring voltage should not exceed the 600 or 800 volts considered safe for an induction machine. There was no difficulty in obtaining a governor to regulate the speed closer than 4 per cent., but if desired all danger could be avoided by interlocking the switch with some centrifugal device (in addition to a visual indicator), which would prevent the handle being moved except when the speed was within, say, 2 or 3 per cent. of the correct value. There was an advantage in the vibratory over the rotary type of phase advancer in that whether the machine generated or motored, the connections remained right, and the machine had an equally good power factor in either condition. Also, it was very easy to regulate the amount of phase advancing given. They need only adjust the exciting current of the advancer. This excitation took about 1,500 watts at normal full load. If left in that condition the main generator would give at 30 per cent. of full load a leading power factor of 0.7, but by reducing excitation this could be brought up to 0.8, so that the working condition of the synchronous machines need not be disturbed. According to this plan, only one-third or one-fourth of the total plant at a generating station would be of the synchronous type, and the rest would be asynchronous. Only the synchronous machines would be protected by reactance coils and extra-heavy automatic circuit-breakers rated to stand about seven times the normal current, as the author suggested. Also, only these machines needed synchronising gear. The remaining plant would be asynchronous, and would need neither reactance coils for protection nor circuit-breakers of a higher than normal rating. Some care would be required to avoid the danger of instability. If the external power factor and external load changed slowly there was no difficulty in so adjusting the excitation of the synchronous machine and that of the phase advancer that a stable condition of working obtained. If there was a sudden and large increase in the external current caused by a fault in a feeder the automatic regulators had no time to act, and that was precisely what was wanted. The bus-bar voltage ought to drop suddenly, so that the breaker in the faulty feeder would open with very much less K.V.A. than it would otherwise do. On the other hand, there might be sudden changes in load of quite a normal character; in these cases the bus-bar voltage should not vary sensibly, and it would, therefore, be necessary in planning the lay-out of the generating machinery to consider very carefully within what limits the system should be made insensitive to sudden changes of working conditions, in other words, to make a compromise between stability and efficient protection on the one hand, and cost of plant on the other. Stability might be obtained by making the K.V.A. capacity of the synchronous plant large, but this increased cost. As some expenditure was saved in reactances and oil switches, the advantage might still be with the combination of synchronous and asynchronous equipment he had suggested.

Discussion at Newcastle-on-Tyne.

At a meeting of the Newcastle-on-Tyne Local Section of the Institution of Electrical Engineers on April 8th, Mr. E. B. Wedmore read his paper on the control of large amounts of power.

Mr. A. H. **Marshall** presided, and said the paper came very opportunely, for they were about to consider at their next meeting the report of the Coal Conservation Sub-Committee on Electric Power. One of the disadvantages of large power systems was that they were more likely to be affected by faults than smaller ones.

Mr. **Beard** said he was glad to see that the author had not gone in for the indiscriminate use of reactances, but seemed to have given an unbiased statement of the case for the use of reactances. He had found very little in the paper that he wished to question, and they had in that district just those conditions which Mr. Wedmore dealt with. He did not quite agree with Mr. Wedmore as to the rating of reactances in reference to the capacity of the plant with which they were associated. It seemed to him that the simplest way to rate them was at so many K.V.A., from which other calculations could be readily deduced, and it avoided any difficulty in regard to the adjoining section. Another point was that Mr. Wedmore had not mentioned the "doubling" effect. He thought it applied to reactances as well as to transformers, but they did not quite realise that this was the case. He did not think that their experience in that district would justify them in going in so largely for oil switches as Mr. Wedmore suggested; it was a debatable point whether the cost would be justified. He would rather put the money in building an oil switch which was better. Referring to bus-bar reactances, he said his conclusions were very similar to those of Mr. Wedmore. Two machines per section were most desirable, and he realised there should be plenty of carrying capacity on the reactances. He pointed out that having settled on the size of the reactance, if a little margin was wanted it must not be thought that the cost would be small, for the cost would be as the square of the increase.

Mr. **Longman** asked if it would be possible to use a choking transformer, had the author considered the question of regulators, and whether it were not possible to incorporate reactances with regulators.

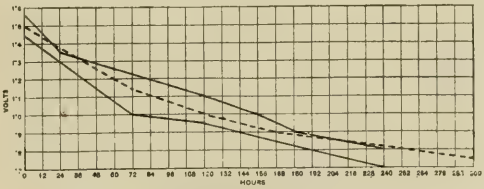
Mr. **Clothier** said, that considering their practice in that district, they had found it possible to run very large systems up to the present time almost independently of the use of reactances. He did not say that that could always continue. Some pointed to the advanced use in America of reactances. He said we were more advanced in having been able to do without them so long. It was not to be forgotten that a reactance was consuming a certain amount of energy, and the more inductance there was the more work the switches had to do. In speaking of the limitation of stresses by preventing faults between phases, the author said it was only faults that occurred between phases that presented a serious problem. Air-insulated conductors could be separated by substantial insulating barriers, and he referred to a good example of an oil switch (fig. 7). He (Mr. Clothier) did not think it was a good example of British practice, but it was a good example of American design. Wherever there were conductors exposed to air, there was always a danger of faults between phases, and he contended that all conductors should be enclosed as far as possible.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Discharge Curves of "Bul" Cells.

Actual discharge curves of dry cells are conspicuous by their rarity, if not their complete absence from the pages of the technical Press, and therefore the accompanying chart, which we have received from The British Utilities, Ltd., of 148, South Park Road, Wimbledon, will be of interest to our readers. It relates to two sizes of their bell cells—No. 1 measuring 2½ in. in diameter and 6½ in. high, and weighing 2 lb.; and No. 2, 2⅜ in. in diameter, 6 in. high, and weighing 1½ lb. In selecting a No. 1 cell from a batch, the first one reading 1·5 volts exactly was chosen for the test, and in the case of No. 2 the first cells reading respectively 1·55 and 1·45 volts were selected; the cells were allowed to discharge continuously through a standard 10-ohm resistance coil to the voltage shown on the chart. It will be seen that the discharge was maintained at a practical working voltage for periods ranging from 240 to 300 hours, representing, of course, several years' working of an electric bell.



Dotted line, No. 1 size.
Firm lines, No. 2 size.

Fig. 1.—Discharge Curves of "Bul" Cells.

E.M.C. Fans.

The Enterprise Manufacturing Co., Ltd., of Gun Street Electrical Works, Bishopsgate, E. 1, are manufacturing throughout a line of electric fans for direct and alternating current, from 12 to 36 in. in diameter, and for all voltages; these fans are fitted with "box" blades, as shown in fig. 2, for which a higher efficiency is claimed as compared with "regulation" blades, though the latter are supplied if desired. The firm manufacture the small motors for these fans, as well as for general use, and carry out all classes of motor repairs; they have recently enlarged their premises to enable them to cope with the work more efficiently.

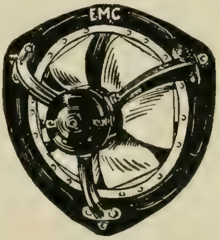


Fig. 2.—E.M.C. Box-blade Fan.

Increasing the Carrying Capacity of Underground Cables.—The thermal resistance between the conductor of an underground cable and the remote normal-temperature environment resides in the dielectric envelope, the air space between the cable and the conduit, the conduit walls and the soil in their immediate vicinity, all taken in series. A considerable share lies in the air space within the duct. The resistance in the dielectric and in the conduit walls may not be susceptible of change. If, however, the duct containing the cable be filled up with some cheap electrically insulating material of better thermal conductivity than air, the total thermal resistance may be appreciably reduced, thereby reducing the temperature elevation of the cable; or, if the cable is thereby kept unnecessarily cool, the original temperature elevation may be retained, with a correspondingly larger electric current. The substitution of crude vaseline for air in a cable duct was found materially to diminish the thermal resistance and corresponding temperature elevation. It remains to be seen whether on a larger scale vaseline is a suitable substance for use in this way; but it is only reasonable to expect that some economical substance should be thus available for replacing air in underground cable ducts, so as to increase the safe electric carrying capacity of the cable.—*Electrical World.*

LEGAL.

Mitchell v. Radio-Electric Lamp Co., Ltd.

At the North Walsham County Court, last week, before Judge Milligan, K.C., W. D. Mitchell, manufacturer's agent, of North Walsham, sued defendant company for £19 13s. 6d., balance of commission earned, and £36 loss of commission, during three months, due to wrongful termination of an agreement. Defendants counterclaimed for £6 16s. 3d. overpaid for commission. It appears from the report of the case in the *Eastern Daily Press* that in December, 1916, defendants purchased the stock, &c., of the A. & A. Electrical Co., with whom plaintiff had an agreement as agent on a retaining fee and commission basis. The defendants employed plaintiff under the terms of the original agreement, subject to a temporary reduction from 30s. to 15s. weekly in the retaining fee. In December, 1917, they ceased to pay the fee, and terminated the agreement. Plaintiff was entitled to 15 per cent. commission on all orders of a certain class booked or introduced and 5 per cent. on orders of other classes.

Plaintiff said that Mr. Holmquist, a Swedish gentleman, who was manager of the defendant company, consented to abide by the original agreement with the A. and A Co., and gave plaintiff an assurance that the Radio lamps were of British make, as he (plaintiff) did not want to handle German or foreign lamps. He had opened out a lot of new ground for the defendants, and when Mr. Holmquist wanted to stop paying the retaining fee plaintiff told him that the agreement could be terminated by three months' notice. He admitted having three agencies, and that he still represented the A. and A. Co., but he did not hold the latter to the agreement, nor was he paid any retaining fee by them.

The defence was that plaintiff was employed at a salary of 30s. to cover expenses, and commission payable when the orders were executed and paid for. In many of the cases the orders were not executed. The A. and A. Co.'s business, taken over by defendants, included Dutch lamps, and the defendants had also an agency for Swedish lamps. An Order in Council prohibited the importation of these lamps, and plaintiff was told of the difficulty there was as a consequence in executing his orders. The retaining fee was reduced, and afterwards discontinued, because defendant forwarded very few orders. There was no agreement for a three months' notice. Counsel urged that it was only a weekly agreement of 30s. and commission, which terminated because defendant ceased to send orders.

His Honour gave judgment for £19 13s. 6d. on the claim, less £6 16s. 3d., the amount of the counterclaim, which was admitted by the plaintiff. He allowed nothing for the three months' notice, holding that the agreement terminated by mutual consent.

Discipline at an Electricity Works.

In the Shoreditch County Court, on Friday, Judge Cluer gave a decision in an action in which H. A. Cradick, of Leighton, a foreman stoker, sued the Mayor, Councillors and Burgesses of the Borough of Hackney to recover £23 6s. 6d., being the sum he had paid to the Council under the Superannuation Act.

Counsel said the plaintiff had been in the employ of the Council in the electricity works since 1901, and had risen to the position of foreman. Lately a Mr. Osborne had come on the scene as charge engineer, and Cradick and he did not hit it. One day Osborne ordered a man named Ansell to stoke up a fire, and rightly or wrongly, Cradick deeply resented it, as it undermined his authority in his opinion, and he lost a certain amount of dignity. There was other stoking to do, and Cradick told Osborne that as he started the job, he had better finish it. The result of it all was that he went on the carpet the next morning, before Mr. Robinson, the borough electrical engineer, who admonished him, and told him that if he liked to apologise to Osborne, and to do his work in future, the incident would be overlooked. Cradick said he had nothing to apologise for, and refused, saying he preferred to leave, and did so. The money he was claiming was his superannuation, which was returnable if he had not been guilty of misconduct.

Mr. Young said that was the whole point, as to whether this was misconduct in refusing to obey orders.

The Plaintiff then went into the box, and agreed with the opening of counsel. In cross-examination he agreed that there had been little cases of friction over him from time to time, but nothing of a serious character. This closed the plaintiff's case.

Mr. Osborne, giving evidence, said he was the electrical engineer-in-charge of the shift. He saw that the steam was going down, so as it was a case of emergency, he did not wait to walk 30 ft. to where Cradick was, but told the man Ansell to stoke up the fire. He then told Cradick what he had done, who told him that as he had started the job, he had better finish it. He badly lost his temper, and when told to open up a damper to allow the back coal to burn, he refused to do so. The works foreman was called in, and he still persisted in his refusal.

Mr. Young (for the defence): Our point is that there must be discipline in a place like this.

Judge Cluer: And if the superior wants it done, he must do it, although I don't know if a hasty word is misconduct.

Plaintiff: It would have been done if he had told me instead of one of my men.

Judge Cluer: He had a perfect right to go to one of your men if he liked, as it was a case of emergency, although of course it is best to go to the foreman. Do you think a hasty word is misconduct within the meaning of the Act?

Mr. Young: If he refused to obey a lawful order, it is misconduct. It has to be borne in mind that at an electricity works, if the power is not kept up, the electric light of the borough is in danger.

Judge Cluer: I should not have been inclined to tell him to apologise, but to tell him to obey orders in future.

Mr. Osborne: I had no wish for an apology; I only wanted him severely reprimanded.

Judge Cluer: All the same, I do not understand the emergency. If 30 ft. is going to endanger the supply of electricity for Hackney, they had better get other officials.

Mr. Thos. Dalby, the works superintendent, said he had had to speak to Cradick a good many times on reports made as to his conduct. He agreed that it was best not to interfere with the leading man.

Judge Cluer: Of course I agree it is his duty to obey, no matter whether it goes wrong, and the steam goes down; the fault would lie with the man who gave the wrong order.

Mr. L. L. Robinson, the borough electrical engineer, said what Osborne did as to Ansell was perfectly correct in an emergency. It was assistance, not interference, and Cradick should have recognised it as such. He was a very funny-tempered man, and it was all according to the mood he was in at any time as to whether he would obey an order. Witness had spoken to him many times, and really thought he was pretty well cured of his temper. This was a climax, however, which, for the sake of discipline, he could not possibly overlook, notwithstanding the need for men at the time. It was not a case of bad feeling between Osborne and him, as there had been incidents with other men before.

Judge Cluer said the man was asked to open the damper and refused, and that was misconduct, inasmuch as it was a refusal to obey orders.

Mr. Fortune said he hoped his Honour would not put the case too high, as he would like it to be realised what he had lost by reason of his hasty temper.

Judge Cluer replied that he had nothing to do with that, only with the legal side of the matter.

Mr. Fortune contended that a refusal to obey a lawful order when in a bad temper was not misconduct, but Judge Cluer said he must hold that it was, and there would have to be a verdict for the defendants, with costs.

Standard Cable Manufacturing Co.

In the Chancery Division, on Tuesday, Mr. Justice Younger had before him a petition by the Board of Trade, under the Trading with the Enemy (Amendment) Act, 1916, for the winding-up of the Standard Cable Manufacturing Co. According to the *Financier*, Mr. Austen-Cartmell said all the trade claims had been paid with the exception of two, one of which was that of an ex-manager for compensation for the termination of his services, and, in any case, there was enough money in hand to settle these claims. The company was an offshoot of a German company, and was really formed for the purpose of assisting that company. The Standard Co. was very much mixed up with the Enfield Co., and there were two agreements to which the German company were parties. These contracts had been determined between the Enfield and the Standard companies. Everything had now been done with regard to the winding up of the company's business.

His Lordship made the usual order.

Rose Bros. v. Morehen.

In the Lord Mayor's Court, on Monday, before the Recorder (Sir Forrest Fulton, K.C.) and a jury, plaintiffs, manufacturers of electrical torch batteries, Milton Street, E.C., sued the defendant, Mr. E. Morehen, electrical engineer, of Oxford Street, for £16 2s. for electric torches, batteries, and bulbs supplied. The defendant claimed to be entitled to a sum of £4 18s. 1d. as an allowance for defective goods supplied by the plaintiffs, and paid the balance into Court. The plaintiffs' case was that in May they received an order from the defendant for torches complete, cases, refills, and bulbs, and on May 22nd and June 20th goods to the amount of £16 2s. were supplied. From June until August no complaint was received from the defendant. On August 28th the defendant wrote complaining that the torches and refills recently supplied by them fell short of his anticipation, and that the batteries were "weeping." To this plaintiffs replied that the torches and batteries must have been used badly, as they sold a large quantity without receiving any complaint. They would be pleased to see the defendant on the matter. Later some goods were returned from the defendant, but he was given notice that they were lying at their warehouse at his own risk. The claim for defective goods was not made until some months after delivery, and too late for the allowance to be made. Some of the goods which the defendant had returned were examined, and had the appearance of having short-circuited. That would account for the condition which the defendant described as "weeping."

The Plaintiff, in his evidence, said that batteries might go wrong in a day occasionally, but it was the customer's duty to test them. If a customer returned goods from stock in three months they would make allowance for defective goods. He was a member of the United Battery Co. who were making batteries, and gave a guarantee for one month only. Every battery was tested and examined before being sent out. They could not now get the finest raw materials, and they had the greatest difficulty to make batteries that would keep in stock for three months.

Cross-examined, Plaintiff said if batteries were returned with seals unbroken in three months they would be allowed for, but they did not guarantee that every battery returned would be replaced.

The DEFENDANT, in his evidence, said he made the purchase of the torches, refills, and bulbs in question after seeing samples at the plaintiffs' place of business. He explained that they were for sale in cinema theatres only. Although some of the batteries were kept in ideal storage they sweated. The original packets of refill batteries became sodden with moisture, and the batteries themselves stuck together, proving that the battery was bad. The batteries had no opportunity of getting short-circuited. He considered the damage was caused owing to chemical decomposition.

The jury found a verdict for the plaintiffs for the amount claimed, including the amount paid into Court.

WAR ITEMS.

Ministry of Munitions and Small Tools.—In pursuance of the instructions of the Controller of Machine Tools, dated February 19th, 1918, Reference H.H.B./G.S., the undertaking to be signed by, or on behalf of, dealers in engineers' and machinists' imported small tools, is now cancelled. The Ministry of Munitions has, however, imposed the following regulations with regard to priority classification in respect of all small tools whether imported or of British manufacture:—

No firm or person is permitted to issue a Class "A" Certificate with an order for small tools unless (a) such small tools form a component part of a direct Government contract, or (b) specially authorised in writing to do so by the Priority Department of the Ministry of Munitions. Any applications for such higher priority must be made through the Director of Small Tools, Charing Cross Buildings, Embankment, W.C. 2.

Any class "A" certificate issued must bear the contract number in the case of (a) and the priority permit number and classification in the case of (b).

Firms holding a P.5 maintenance permit are authorised to quote their maintenance permit number and priority classification on orders for small tools up to the value allowed under the terms of their maintenance permit.

All other firms and persons placing orders for small tools required for the upkeep of existing industrial plant should issue a Class "B" Certificate with their order.

Orders for small tools without certificates may only be accepted when such orders can be executed from stock, and without prejudice to orders received with classification certificates as above.

Regular dealers ordering small tools for stock may issue a class "B" certificate with their order, but if they do they must only dispose of such small tools in accordance with the regulations set forth on the back of the certificate. They should, however, note that *bona-fide* munitions workers, or soldiers engaged on mechanical work who desire to purchase small tools in connection with such work may properly sign class "B" certificates provided that they state thereon the names of their employers or the units to which they belong.

It will be noted that dealers desiring to obtain small tools for sale to the general public without certificates can only obtain same by placing an order without a certificate, and such order will only receive attention when the supplier is in a position to give delivery from stock without prejudice to orders received with classification certificates.

It will be noted that the above regulations do not permit the issue of a class "A" certificate for small tools which are required for the manufacture of goods ordered on a direct Government contract, *e.g.*, a firm having a direct contract from the Ministry of Munitions for the manufacture of guns may issue a class "A" certificate bearing the appropriate priority classification attached to the contract for any of the material used in the manufacture of the guns, but such a firm can only issue a class "B" certificate for the small tools to be used in the manufacture of the guns.

The forms of priority classification certificates referred to (sometimes known as Munitions Certificates) can be obtained from all the principal Post Offices.

Exports to China.—The "London Gazette" for April 12th contains further names of bodies and persons in China to whom exports may be consigned.

Discharged Soldiers as Tramway Employés.—By an Order of the Home Secretary, a licence to act as driver or as conductor of a tramway car, or, on the special recommendation of a proprietor, a licence to act either as driver or as conductor of a tramway car may be granted by the Commissioner of Metropolitan Police to a discharged soldier or sailor who is physically fit for the work, and not less than 19.—*Times.*

Ministry of Munitions and Mica.—The Minister of Munitions has issued an Order prohibiting the purchase, delivery, or sale of any mica as defined below situated in the United Kingdom except under licence. The use of any mica for the purpose of any manufacture or work except under licence is also prohibited, and returns have to be sent to the Controller of Non-Ferrous Materials (MS/R), Ministry of Munitions, 8, Northumberland Avenue, W.C. 2, with regard to stocks, purchases, sales, and deliveries of mica, and any contracts or orders made or given to or by them requiring for their execution the use of mica, as shall be required by the said Controller. All applications for licences are to be made to the said Controller, and marked "Mica Licence." The expression "mica" means block mica of the following quality and size grades:—

Clear and partly stained "Ruby" of "best" or "Government standard" quality, or suitable for use in the manufacture of magneto condenser plates, in size grades No. 3 to No. 6, inclusive, or their equivalent in rectangular or other trimming, including mica coming within the above definition when split from block of any quality.

Glasgow War Savings Scheme.—In connection with the War Savings Campaign in Glasgow, the T.C. tramway department promoted a fortnight's tombola, the prizes ranging from £2,500 downwards. Subscribers paid the full 20s. for £1 War Savings Certificates, and after defraying the prizes the surplus is to be given to various war relief funds. For the first week fully £46,000 was received, and the first allocation of £5,000 among war charities has been made. The "draw" takes place next week.

Exemption Applications.—At Burnley, last week, an electrical engineer (25, B 1) was said by his employer to be engaged on important Government work. The case was adjourned for 14 days, the Chairman saying that a man of 25 could not be kept out of the Army.

At Rochdale, the Corporation Tramways Committee appealed for J. T. Hoyle (35, B 1), control cleaner and examiner. The Chairman said it would have to be a very sound appeal to keep Hoyle out of the Army, and Mr. G. Webster, tramway manager, said his plea was public safety. It took years to train a man to this work, and a dirty control might mean an accident. It was decided that Hoyle must report on May 15th.

At Oxford, exemption was claimed by E. Green (36, Grade 3), electrician with Messrs. Wyatt & Son. Two months' temporary exemption was allowed.

At Swindon, the cases of five tramcar drivers and an inspector were considered. Mr. T. Medcalf, for the Corporation, said that they had no-one to take the places of these men. He did not think it would be advisable to have women drivers, and it would be a dangerous experiment on the single lines. The Tribunal adjourned all the cases.

At Dartford, the U.D.C. appealed for the retention of Lugi Di Norcia (Grade 1), an Italian, and an assistant stoker at the electricity works. He was given two months, with no further application without leave.

Before the Dartford Rural Tribunal, exemption was claimed for F. Luff (30, C 2), electrician at the London City Mental Hospital, Stone, and six months were conceded.

Three months' exemption has been granted to H. O. Baker (18, Grade 3), engaged in the tramway department of the Maidstone Corporation.

At the Stepney Tribunal, Mr. W. C. P. Tapper, borough electrical engineer, applied on behalf of five employés at the Stepney electricity works who had previously held protection cards from the Ministry of Munitions. These had now been withdrawn. Mr. Tapper explained that the men were at present doing eight-hour shifts; if they were called up and substitutes could not be obtained it would be necessary for those who were left to do 12-hour shifts in order to cope with the work. The Tribunal refused the application of G. Lepley, motor attendant, Class A, but gave 90 days' grace. They refused the application of F. Paul, Class A, but gave 60 days' grace. To W. Green, coal porter, who had not been graded, exemption was refused unconditionally, as was also that of A. Moseley, engine-room assistant, Class A. In the case of L. Newman, driver, Class A, the application was refused, but he was given 30 days' grace.—*East London Observer.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Restrictions on the Use of Lead-covered Cable.

In your issue of March 8th, page 233, a note appeared under the heading "Restriction of the Use of Lead-covered Cables," which has given rise to such serious misunderstanding that the Cable Makers' Association feel it necessary to make a statement calculated to remove the impression produced.

The note sets out certain recommendations made by the Cable Makers' Association to the I.M.E.A., adding an expression of the views of the I.M.E.A., and stating that the C.M.A. had expressed the opinion that it is impossible to obtain a satisfactory substitute for lead-covered cables for extra-high and high-tension work. These statements together are being taken as the opinion of the C.M.A. generally on the use of certain types of cable for certain work and certain pressures.

The misunderstanding arises from the fact that the limitations set out in the correspondence, and which no doubt gave rise to this erroneous impression, were given in a reply to Mr. Roles's request for the C.M.A.'s recommendation, as to what cables could be used for *repairs or extensions to existing lead-covered cable systems*, if lead-covered cables cannot be obtained, and were given as applying only to this case, and having in view the probability that they would be treated as if they were lead-covered cables.

The reply of the C.M.A. specially pointed out that the statements must not be taken to be of universal application.

The types of cable in question, that is, paper insulated bitumen sheathed, bitumen insulated, and rubber insulated cables, are frequently used, and can be fully recommended under suitable conditions for considerably higher pressures than those mentioned.

Llewellyn B. Atkinson,
Secretary, Cable Makers' Association.

London, *April 16th*, 1918.

POWDERED COAL.*

The present fuel situation makes the following tests with powdered coal of interest to every central-station engineer and coal user.

It was about the first of 1917 that a series of experiments were begun in burning powdered coal in a 300-h.p. Babcock and Wilcox boiler in the Western Avenue station of the Puget Sound Traction, Light & Power Co., which were in intermittent progress some seven months. The results warranted the purchase of pulverising mill, dryer, and all other equipment necessary for the complete installation of powdered coal plant for 2,400 h.p. of boilers.

If not already to size, the coal is crushed to ¾ in., and then fed into the dryer. The degree of dryness required to prevent any cohesion of the particles which would interfere with pulverisation varies from 1 to 6 per cent., according to the form in which the moisture occurs in the coal.

Likewise, the fineness necessary to allow complete combustion while the fuel is still suspended is somewhat dependent on the character of the coal. With lignites and subbituminous coals, which have a high volatile content and high fusing point of the ash, a less fine degree of pulverisation is permissible than with coals having a greater proportion of fixed carbon. To get the best results U.S. coal should be ground up so that 95 per cent. will pass through a 100-mesh screen, and 85 per cent. through a 200-mesh. However, good results are obtained with considerably coarser coal.

There is a rather prevalent opinion that powdered coal is extremely dangerous to handle, but experience has clearly proved that with reasonable precaution there is no likelihood of explosion or spontaneous combustion.

To transport the pulverised coal, a box car was equipped with a metal-lined hopper, so as to be air-tight and prevent the absorption of moisture. The coal was discharged into an enclosed conveyor, which elevated and dumped it into the bunker. From the bottom of the bunker the coal was fed into the supply pipes by two motor-driven screws. The bunker being about 30 ft. from the boiler front, the coal was conveyed this distance by compressed air.

Bearing in mind that the requirements of an ideal burner are to give a thorough mixture of coal and air with the minimum discharge velocity that will keep the fuel suspended until completely burned, the author devised a burner which, by repeated test, has been proved satisfactory.

As it is necessary to have sufficient space in the furnace for the combustion to take place without contact with the boiler tubes, and to avoid the blasting effect of the flame impinging on the brick work, an extended furnace, commonly called a "Dutch oven," was provided. With some installations, the tendency of certain coals to slag has proved very troublesome, but in this case that feature was handled most satisfactorily by means of a slag pit beneath the furnace, constructed so that the slag cannot cling to the sides.

Records have been preserved of many of the test runs in which representative kinds of coal were burned; among these were samples from screenings which had been 10 to 15 years under water in Lake Washington; Tono, which runs only approximately 8,000 b.th.u. per lb.; Renton, including sludge off the dump, which in raw state analysed over 21 per cent. ash and 30 per cent. moisture; and samples from California and British Columbia.

The following is a record in brief of a representative test of a 300-h.p. Babcock & Wilcox boiler burning powdered coal, lasting 14 hrs. 38 mins.:—

Temperature of water, 186 deg. F.
Temperature of steam (209 deg. C.), 408 deg. F.
Steam pressure, gauge, 116 lb.
Temperature due to pressure, 347 deg. F.
Superheat, 61 deg. F.
Factor of evaporation, 1.1.
Evaporation per lb. of coal:—
  As fired, 7.64 lb.
  From and at 212 deg. F., 8.42 lb.
Draught in uptake in inches of water, .27.
Draught in mixing chamber, .208.
CO_2 by recorder, 13¾ per cent.
Flue gas temperature by pyrometer, 475 deg. F.
B.th.u. per lb. of coal, raw, 9,449.
B.th.u. per lb. of coal, powdered as fired, 10,967.
Efficiency, 75 per cent.

Coal Analysis.

	Raw.	Dried.	Powdered.
Water	15.20	7.11	5.44
Volatile	39.14	42.68	45.32
Fixed carbon	32.10	37.32	35.57
Ash	13.56	12.89	13.67
	100.00	100.00	100.00
Sulphur	.37	.42	.39
B.th.u.	9,449	10,862	10,967

The results of this series of tests with powdered coal may be summed up in brief as follows:—

It was found that different kinds and grades of coal could be prepared, transported, stored, and burned with the same equipment, without physical difficulty.

That low-grade coals that cannot be burned efficiently in any other manner gave good results in the powdered form.

That higher efficiency was obtained than with any other means of combustion.

That the powdered coal fire proved remarkably flexible, it being possible to force the boiler to 200 per cent. of rating in a few minutes without any apparent injury to heating surface or brickwork.

That it was easy to operate, requiring but little attention, and thoroughly dependable.

That the fire was smokeless, even under heavy overload.

That the increased capacity of boilers with pulverised fuel means less investment, and hence a saving through lower fixed charges additional to that due to greater efficiency.

While experience with powdered coal is yet too limited to speak authoritatively on the expense of preparation, the cost would probably be from 30 to 60 cents a ton, depending on the quantity handled at the plant. In working out the equivalent costs of various fuels for any special case, careful consideration should be given to the advantages previously mentioned.

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* Abstract of article by W. J. Santmyer, from the *Journal of Electricity*. Vol. 40, No. 4.

TRADE STATISTICS OF SIAM.

The following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1917, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1916, are included for purposes of comparison, and notes of any increases or decreases are given. Japan's increased participation is noteworthy. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *viâ* these two ports:—

	1915-16. Ticals.	1916-17. Ticals.	Inc. or dec. Ticals.
Parts of lamps.—			
From Singapore	7,000	7,000	—
,, Hong-Kong	6,000	4,000	− 2,000
,, United Kingdom ...	24,000	42,000	+ 18,000
,, Japan	5,000	12,000	+ 7,000
,, United States ...	5,000	9,000	+ 4,000
,, Other countries ...	—	7,000	+ 7,000
Total	47,000	81,000	+ 34,000
Electrical goods and apparatus.—			
From United Kingdom ...	146,000	266,000	+ 120,000
,, Germany	5,000	—	− 5,000
,, United States ...	127,000	175,000	+ 48,000
,, Singapore	5,000	16,000	+ 11,000
,, Sweden	22,000	31,000	+ 9,000
,, Italy	28,000	30,000	+ 2,000
,, Switzerland ...	—	5,000	+ 5,000
,, Holland	21,000	51,000	+ 30,000
,, France	5,000	5,000	—
,, Japan	27,000	263,000	+ 236,000
,, Other countries ...	25,000	13,000	− 12,000
Total	411,000	855,000	+ 444,000
Lamps.—			
From Singapore	13,000	4,000	− 9,000
,, Hong-Kong	39,000	135,000	+ 96,000
,, United Kingdom ...	17,000	21,000	+ 4,000
,, United States ...	16,000	17,000	+ 1,000
,, Japan	83,000	113,000	+ 30,000
,, Other countries ...	4,000	8,000	+ 4,000
Total	172,000	298,000	+ 126,000
Manufactures of brass.—			
From Hong-Kong	452,000	310,000	− 142,000
,, United Kingdom ...	54,000	59,000	+ 5,000
,, China	52,000	58,000	+ 6,000
,, Japan	42,000	48,000	+ 6,000
,, Other countries ...	32,000	46,000	+ 14,000
Total	632,000	521,000	− 111,000
Manufactures of copper.—			
From Hong-Kong	1,000	1,000	—
,, United Kingdom ...	7,000	24,000	+ 17,000
,, Other countries ...	5,000*	5,000†	—
Total	13,000	30,000	+ 17,000

*Italy Tls. 2,000; †Singapore Tls. 3,000.

	1915-16. Ticals.	1916-17. Ticals.	Inc. or dec. Ticals.
Prime movers, other than road locos, marine, milling, and agricultural machinery.—			
From United Kingdom ...	68,000	26,000	− 42,000
,, United States ...	5,000	—	− 5,000
,, Other countries ...	24,000*	15,000†	− 9,000
Total	97,000	41,000	− 56,000

*France Tls. 21,000; †Singapore Tls. 13,000.

	1915-16. Ticals.	1916-17. Ticals.	Inc. or dec. Ticals.
Scientific Instruments and apparatus.—			
From United Kingdom ...	13,000	36,000	+ 23,000
,, Germany	2,000	—	− 2,000
,, France	10,000	1,000	− 9,000
,, Japan	7,000	36,000	+ 29,000
,, United States ...	8,000	10,000	+ 2,000
,, Other countries ...	12,000	17,000	+ 5,000
Total	52,000	100,000	+ 48,000
Machinery unenumerated, including detached parts, and not including agricultural, textile, or sewing machines.—			
From United Kingdom ...	240,000	301,000	+ 61,000
,, Denmark	226,000	41,000	− 185,000
,, United States ...	118,000	494,000	+ 376,000
,, Other countries ...	35,000	109,000*	+ 74,000
Total	619,000	945,000	+ 326,000
*Hong-Kong Tls. 77,000.			
Iron and steel wire manufactures.—			
From United Kingdom ...	79,000	95,000	+ 16,000
,, Germany	1,000	—	− 1,000
,, United States ...	46,000	52,000	+ 6,000
,, Other countries ...	19,000	23,000	+ 4,000
Total	145,000	170,000	+ 25,000
Railway material.—			
From United Kingdom ...	201,000	318,000	+ 117,000
,, United States ...	70,000	—	− 70,000
,, Other countries * ...	62,000*	53,000†	− 9,000
Total	333,000	371,000	+ 38,000
*India Tls. 30,000; †British N. Borneo Tls. 50,000.			
Cars or trucks for railways or tramways.—			
From United Kingdom ...	357,000	201,000	− 156,000
,, United States ...	—	8,000	+ 8,000
,, Other countries ...	—	1,000	+ 1,000
Total	357,000	210,000	− 147,000
Caoutchouc manufactures, other than tires.—			
From Singapore	75,000	81,000	+ 6,000
,, United Kingdom ..	30,000	49,000	+ 19,000
,, United States ...	3,000	3,000	—
,, Japan	7,000	23,000	+ 16,000
,, Other countries ...	4,000	7,000	+ 3,000
Total	119,000	163,000	+ 44,000

Note: £1 = about 13 Ticals.

BUSINESS NOTES.

Lamp Manufacturing in France.—A new company has lately been formed in Paris with a capital of £20,000 and the title La Société des Establissements G. Angenault. "Lampes Lumen," to acquire and carry on an electric lamp manufacturing business at Courbevoie (Seine).

Ignition and Lighting Material for American Military Motor Wagons.—Instead of placing contracts for complete motor wagons for the Army, the American Government has adopted the plan of having the vehicles assembled in a number of the leading petrol motor wagon works, placing the orders itself for the various components required. As a first supply, no fewer than 10,000 vehicles of what is known as the B Class are being produced, and in connection therewith the U.S. Quartermaster's Department has recently given out contracts for 10,500 ignition magnetos. The vehicles will be provided with electric lighting equipment, and in connection with this, 12,000 generators have been ordered, as well as 12,000 distributors and coils and 12,000 switches. As regards electric batteries for use in connection with the lighting sets, 14,000 have been put on order, together with 11,500 sets of lamps.

Plant for Sale.—Hoylake and West Kirby U.D.C has for disposal a superheater for Lancashire boiler. Particulars are given in our advertisement pages to-day.

Book Notices.—"Frenzied Liberty: the Myth of a Rich Man's War." By Otto Kahn. Extracts from an address given at Wisconsin University, January, 1918. Also by the same author, "The Poison Growth of Prussianism," an address given at Wisconsin, January, 1918.

"The Russian Riddle." By Zinovy N. Preev. London: J. Bale, Sons & Danielsson, Ltd. 6d. net.—The author examines the manifold causes of Russia's military collapse and the world situation created thereby, as it affects the Allies. The enormous handicaps of Russia, the rise and failure of the Bolshevists, and other matters, are reviewed and ways are suggested for assisting Russia to extricate herself from the present crisis. In spite of her military collapse, Mr. Preev holds that Russia remains the most important battlefield where Germany can and must be defeated economically if she is not to recoup herself in the East for her disappointments in the West. An appeal is made to British statesmen and business men to help in Russia's reconstruction, and not to allow Germany to monopolise that task for her own predatory ends.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 3. March, 1918. New York: The Institute. Price $1.

"Syndication in the Brass Industry." By Howard F. Smith.—Copies of this pamphlet may be obtained from the author (7, Hampton Street, Birmingham), who is a director of Smith and Davis, Ltd. He has issued it to serve as a basis of discussion, and to bring to a focus the ideas that have been forming in the minds of business men connected with the industry. He advances a rough embryo scheme of organisation.

"Science Abstracts" A & B. Vol. XXI. Part 3. March 31st, 1918. London: E. & F. N. Spon. Price 1s. 6d. each.

Liquidations.—Calvert's Circulation Fuel Economiser, Ltd.—This company is winding up, with Mr. F. J. Drane, 36, John Street, Bedford Row, W.C., as liquidator.

Electricity Supply Co. for Spain, Ltd.—Meeting of creditors, April 24th, at Dunster House, Mincing Lane, E.C. 3. Liquidator, Mr. D. Merry del Val.

Catalogues and Lists.—British Insulated and Helsby Cables, Ltd., Prescot.—Eight-page illustrated list of 174 contracts for the erection of Prescot pole lines in the United Kingdom down to December last. The contracts comprise 335 miles run of overhead equipment for lines ranging in pressure from 220 to 20,000 volts, lines at the latter pressure numbering 37 and covering 126 miles' run of equipment.

Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough. Illustrated bulletin (four pages) containing a specification and tabulated dimensions of their static tranformers.

Trade Announcements.—Mr. Thomas Armitage, electrician, 3, John Street, Huddersfield, having decided to give up business, the stock-in-trade, &c., are to be sold by auction.

The Wholesale Fittings Co., Ltd., 23-27, Commercial Street, E. 1, have opened a branch depôt (in charge of Mr. H. Thompson) at 14, North Street, Stokes Croft, Bristol, for the convenience of their West of England and South Wales customers.

The New British Electric Supply Co., Ltd., and Messrs. Berkeley & Young, Ltd., announce that, their premises in Finsbury Court having been taken over by the Government for the Casualty Records Department, they have temporarily removed to Stevenage House, 40-44, Holborn Viaduct, E.C. 1. New telephone numbers, "Holborn 1150/1" (two lines).

LIGHTING AND POWER NOTES.

Aberystwyth.—Hydro-Electric Scheme.—The T.C. has referred the proposed hydro-electric light scheme to the Public Works Committee for full consideration.

Australia.—Victoria.—The case for water, as against brown coal, as a means of generating electrical energy was put before the Minister of Mines, on February 8th, by a deputation representing the shareholders of the Victorian Hydro-Electric Co., which has a scheme for utilising the waters of the Kiewa and other rivers.

Mr. Holdensen, chairman of directors, asked for a straight-out answer as to whether the Government proposed to carry out the scheme itself, or grant the company the lease it sought, and allow it to carry out the work. A large amount of preparatory work had been done by the syndicate, at a cost of £6,000. The object of the company was to unite all the available water power between the Kiewa and Snowy rivers, which, when all catchments were utilised, would, it was estimated, produce more than 100,000 H.P. The company would supply distributors of energy in city and country centres for industrial purposes at a maximum rate of $\frac{3}{8}$d. per unit. The estimated total outlay was £878,000. The company's estimated cost of production at the Kiewa station was $\frac{1}{10}$d. per H.P.-hour, as against $\frac{4}{10}$d. per H.P.-hour from brown coal at Morwell.

The Minister, in reply, said the Government recognised the urgent need of providing cheap power for industries. The question was not that of Morwell or Kiewa, but one of the advisability or otherwise of the Government developing the great water power which was said to be available, or allowing a private concern to take the matter in hand. The question would have to be submitted to Parliament, and the matter would be on a firm footing by the time Parliament again met in June or July next. A Bill would be introduced for securing cheap power for industries for both city and country from either water or coal, or both.—*Melbourne Leader.*

According to the *Melbourne Age*, the State Ministry has decided that before undertaking the development of brown coal deposits at Morwell or elsewhere, for the supply of electrical energy to existing and prospective industries, an investigation shall be made into the possibility of utilising the water power of the State for the same purpose.

A Sectional Committee of the Victorian Industries Committee, and subsequently a Special Committee of experts engaged by the Government, reported strongly in favour of the establishment of a power house at Morwell, at a cost of nearly £2,000,000. The Committee urged that steps be taken at the earliest possible moment to obtain Parliamentary sanction for the scheme, and for the creation of the necessary authority to initiate and control it.

Mr. H. R. Harper (city electrical engineer) stated that exhaustive experiments had shown that brown coal was a first-class fuel, particularly for the production of power.

Bradford.—Price Increase.—The City Council, last week, approved the Electricity Committee's proposed advances of electricity charges. Alderman G. H. Robinson, chairman of the Committee, explained that the cost of various items over pre-war rates had gone up, calculated on the same output, by £60,693. If the conditions had been as in 1914, there would have been a profit of £39,843. and the "coal clause" in connection with bulk consumers had brought in over £21,000 which would not otherwise have been received. The increased cost of coal was £25,780; other materials, £2,100; rates, &c., £2,492; salaries and wages, £19,606; and interest and sinking fund, £10,715. The profit was only £721.

Bristol.—Street Lighting.—The *Daily Chronicle* states that for the sake of economy there will be no public street lighting in the city from May 15th to August 13th. This decision was confirmed after being criticised at Tuesday's Council meeting.

Continental.—Norway.—According to a U.S.A. Consular report, the village of Risor, which is between Christiansand and Christiania, is projecting steel works and rolling mills to turn out 30,000 to 40,000 tons per year. It will utilise as far as possible electric power and electric heat for smelting; this will be derived from the Hoge Falls, the first transmission project being of 22,000 H.P. It is said that from 150,000 to 200,000 H.P. may be obtained from these falls.

Hungary.—According to the *Evening News*, a Zurich telegram states that a new electric generator at the Budapest electrical works exploded on Thursday, last week, setting the whole building on fire and blowing the roof off. Large bars of iron were hurled into the air, and 10 workmen were injured.

Darwen.—Wages.—The electricity employés of the Corporation have given 21 days' notice to cease work unless they receive an advance of £1 a week and 12½ per cent. war bonus.

Dewsbury.—National Electricity Supply.—In presenting the new rate estimates before the T.C., last week, Alderman Sir Mark Oldroyd, mentioned the Board of Trade's national scheme of centralised electricity production, and advised that for the present no new capital should be invested in that direction, and if demand exceeded supply the T.C. should resort to purchase from the Yorkshire Electric Power Co. Sir Mark Oldroyd foreshadowed the partial, if not wholesale, scrapping of the Corporation electricity and gas undertakings.

Dundalk.—It was reported at the Urban Council that the Great Northern Railway (Ireland) Co. had agreed to make good one-half the total loss incurred by the delay of 14 months under the agreement for electricity supply to them, and to pay a nominal extra rate per unit for the entire supply to cover increased working expenses over and above the extra rate provided for in the agreement.

Ealing.—Street Lighting.—The *Times* states that, except in main roads and a few other places at Ealing and Hanwell, the street lamps will not be lighted during the summer.

Greenock.—Loan.—The Corporation is applying for further electricity department borrowing powers to the extent of £82,000 for extensions—boiler, condensing, and transforming plant.

India.—The draft of a model or standard form of conditions, rates, and general information for the supply of electrical energy prepared by the Electrical Adviser to the Government of India, is being circulated amongst all Local Governments and Administrations in the Dependency for criticism. It is understood that the form of conditions will be submitted for discussion at the next Conference of Electric Inspectors and Electrical Engineers to Government to be held in Calcutta.

Limavady (Co. Londonderry).—Street Lighting.—A scheme for the public electric lighting of the town is being discussed as a result of the Urban Council's decision to close down the gas works, owing to war-time conditions.

London.—Marylebone.—The Electricity Committee reports that a meeting of gas and electrical engineers of London, convened by the Coal Controller, was informed that both industries would have to use 10 to 30 per cent. less coal. This, however will not affect the Committee's undertaking, as two more boilers will be fitted this year with stokers burning coke-breeze, and it is hoped to get four more fitted in a short time.

Morpeth.—At a meeting of the T.C., on the 10th inst., it was decided to support Newcastle in its action with respect to the charges proposed to be made by the electrical supply companies.

Newcastle-upon-Tyne.—Price Increase.—The Parliamentary Committee of the City Council recently submitted a report concerning the proposal of the Newcastle Electric Supply Co. to increase the charges for electrical energy supplied for lighting purposes by 20 per cent., and for heating by 15 per cent., The Committee stated that it was of opinion that, having regard to the circumstance that the company was in a position to pay a dividend of 8 per cent. per annum, there was no justification for the contemplated increase, and that representations should be made to the B. of T. with a view to a reduction in the maximum price of electrical energy supplied to private consumers for lighting and heating in the city. The report also stated that the Newcastle and District Electric Lighting Co. had issued a similar notice with respect to its supply of electrical energy in the west of the city, and the Committee recommended that representations be made to the B. of T. upon the subject, with a view to the grounds of the proposed increases being investigated, and also with a view to a reduction in the maximum prices.

The Lord Mayor (Sir George Lunn) moved the confirmation of the report, and said the two companies had monopoly rights of supply throughout the city. The present flat rates were 3¾d. per unit for lighting and 1½d. per unit for heating. No explanation or justification had been given to the public for this heavy increase in the cost of electrical energy. For the year ended December 31st, 1917, the profits of the Newcastle Electric Supply Co. were large, and the dividend on the ordinary shares the highest ever paid. But whatever might be the explanation of the increased output of electrical energy—increased consumption in industrial works, extension of the company's works over a larger area—any of these factors, or all in combination, there was the anomaly that at the moment when the profits were at the very highest, and the dividend touched 8 per cent., the company felt impelled or compelled to put up the price against the ordinary consumer. The Committee felt that it would like to be assured it had the Council behind it, as it certainly would have the users of electricity, in any steps it took to resist any increase in prices. It wanted an inquiry into the proposed increases, for it was such increases. apparently quite unnecessary, that would give force to the demand that public utility services, with monopoly privileges conferred by statute, should pass from private hands into those of the municipal authorities governing the areas concerned, who could protect the public and apply the services to the advantage of those using them.

The report was formally seconded and adopted.

Newcastle-under-Lyme.—Diesel Engines.—Referring in a note in our last issue, the borough electrical engineer, Mr. A. J. C. De Renzi, writes to point out that the Ministry of Munitions did not suggest that electricity works should install Diesel engines. What they did urge was that in stations where Diesel engines were already installed, the necessary alterations should be immediately proceeded with to enable these engines to run on tar oil in place of imported fuel oil.

Sheffield.—Linking-up.—The Electricity Supply Committee reports that further meetings of the Joint Committee with reference to electricity supply to Sheffield, Rotherham, &c., have been held. Negotiations have taken place on the basis that the cost of linking up cables, transformers, &c., for connecting up the Sheffield and Rotherham power stations would be approximately £50,000. This, it is estimated, would involve an annual expenditure of £4,000, of which it was assumed that each Corporation would pay one-third, and the Ministry of Munitions one-third. It has now been arranged that the Sheffield Corporation shall pay the whole cost of the above works, and the repair and maintenance of the same, which shall be its property. and that, in view of the above arrangement, and on the understanding that the Ministry of Munitions will contribute one-third of the capital cost of the works, the Rotherham Corporation shall make a deduction from the price to be paid for energy supplied by it to the Sheffield Corporation under the present scheme, at the rate of £130 per million units sold (= ·0312d. per unit); that rate of deduction to continue to apply until a maximum of 10 million units has been reached in any year, and thereafter, if the Corporation takes more than 10 million units a year, no further deduction shall be made.

Sunderland.—Linking-up.—At a meeting of the T.C., on the 10th inst., it was agreed that a communication be sent to the Lords Commissioners of the Treasury deprecating the acquiescence by the Treasury in the issue of £600,000 mortgage debentures in connection with the proposal to establish a power station for linking-up with the systems of the Newcastle-upon Tyne Electric Supply Co., Ltd., as being calculated to conserve the private monopoly at preent exercised by the company in Northumberland and Durham, and tending to make more remote the possibility of an adequate public control of the electricity supply of the two counties.

Price Increase.—The Council has decided to increase the tariff to long-term H.T. consumers by 15 per cent.

United States.—President Wilson signed an Order on February 25th authorising the construction of the largest of the dams on the Tennessee River, projected some years ago as the Muscle Shoals hydro-electric development. The construction is to be carried out with funds derived from the appropriation for a Government nitrate plant, which was made by Congress in 1916, and the hydro-electric plant, when completed, will become a part of the two nitrate plants now being built near Muscle Shoals, at Sheffield, Ala. These two plants are (1) a factory for the fixation of nitrogen, which will produce approximately 20,000 tons of ammonium nitrate a year, and will be owned and operated by the United States, and (2) a plant owned by the United States, but operated by the Air Nitrates Corporation, which will produce 110,000 tons of ammonium nitrate a year. Electricity used in the operation of these plants will be generated by steam power, and will be brought from distant hydro-electric plants for initial operation, but will eventually be produced at Muscle Shoals.

The Commonwealth Edison Co., of Chicago, is completing the installation, at Northwest Station, of three additional turbo-generators of an aggregate capacity of 95,000 KW. Two are of the compound reaction type, and the third is an impulse machine of new design. One of each type is now in operation, and the second compound machine is in course of erection. At the turbine throttle steam is supplied at a pressure of 230lb. gauge and 200° F. superheat. With the present installation of three turbo-generators, two with a rating of 30,000 KW. and one of 35,000 KW., station will have an aggregate rated capacity of 165,000 KW. The plans calling for six units will have been completed, and the present building fully equipped.

The operating revenue of the company for the year ended December 31st, 1917, was $25,351,585, an increase of 10·9 per cent. over the previous fiscal year. The net operating revenue for 1917 amounted to $8,723,702, as compared with $8,133,073 in 1916. The net sum available for dividends was $4,677,077, or 10·21 per cent. on the company's capital stock, as compared with $4,399,413, or 9·6 per cent. on the stock, for the previous year. Amortisation and depreciation reserve absorbed $2,836,246, taxes and municipal compensation $2,229,906, and interest on bonds $2,131,550. The balance carried forward was $1,009,725. The total capitalisation is $50,422,826. During the year approximately 31,000 new customers have been added, making a total of 351,700 customers. This represents an increase of 97,000 KW. in connected load. The highest maximum load recorded during the year was 392,330 KW., an increase of 6 per cent. The company's connected business (exclusive of electrical energy supplied to other public service corporations) amounted to the equivalent of 15,336,791 50-watt lamps on December 31st, 1917.—*Electrical World.*

Yorkshire Power Co.'s Bill.—The B. of T. has now completed its report, and, without expressing any opinion on the merits of the questions raised by it, suggests that, pending any action that may be taken as a result of the report of the Coal Conservation Sub-Committee of the Reconstruction Committee and of that of the Electric Power Supply Committee, it is inexpedient that the powers sought by Clause 3 of the Bill should be conferred on the Yorkshire Electric Power Co. The company has, in deference to this suggestion, decided not to proceed with Clause 3.—*Yorkshire Post.*

TRAMWAY AND RAILWAY NOTES.

Ayr.—Fares.—The T.C. has decided to abolish halfpenny fares on the tramways.

Australia.—Melbourne Suburban Railway Electrification.—The chairman of the Victorian Railway Commissioners recently informed a deputation from the Sandringham Council that it was anticipated that electric trains on the Sandringham-Essendon line would be running by the middle of June next. The Department has started the instruction of train crews, and, later, trial runs will be made on the Flemington race-course line to give practical instruction to the staff referred to.

Bradford.—The B. of T. report upon the inquiry by Col. G. W. Pringle into the circumstances attending the accident which took place, on February 1st, on the Allerton section of the Corporation tramways, in which 19 passengers were injured and the driver was killed, states that the accident was caused by speed very much in excess of that authorised. There was no failure in brake or other equipment, but fog and darkness may have been contributory factors. Col. Pringle recommends various alterations in speed regulations, that stops be properly enforced in the future, and that dangerous points be indicated at night by red lamps.

Birmingham.—Fares.—Owing to traffic restrictions, the tramcars will not be run after 11 p.m. The minimum fare on the omnibuses is increased to 2d.; also children's fares on tramcars and 'buses. Application has been made to the Board of Trade for sanction to alter the regulations, which now require that the penny stage on the tramways shall be 2 miles long. The intention is to reduce the stages.

Burnley.—Wages.—The Committee on Production has upheld the contention of the Corporation that the women employed on the local tramways are not entitled to the same advance as the men under Clause 4 of the finding of March 8th regarding tramway and omnibus workers.

Continental.—Spain.—Over 2,000 men are now employed on the construction of the North-South Underground Railway in Madrid, about 1 km. of the tube having already been pierced and lined.

Halifax.—Year's Working.—The annual report of the Corporation tramways to March 31st, 1917, shows total revenue £115,074, working expenses £76,136, leaving a gross profit of £38,938; interest and sinking fund absorbed £23,826, leaving a net profit of £15,112, as against £19,055 in 1916; average total revenue per car-mile, 13·48d.; average total expenditure per car-mile, 11·71d.; car-mileage, 2,048,722, a decrease of 147,208 miles; passengers carried, 21,180,584, an increase of 164,581. Owing to a correspondent's error, the figures given under the above heading in our last issue were inaccurate.

A one-man tramcar has been fitted up with an apparatus for keeping hot the meals it is to take from the communal kitchen distributing centre to the branch kitchens in the town.

Lancaster.—Prov. Order.—An L.G.B. inquiry was held recently by Mr. R. C. Maxwell regarding the application of the Corporation for a prov. order to increase the number of electric 'buses at present running. In support of the application the chairman of the Tramways Committee stated that a profit of between £600 and £700 had resulted from the running of three electric 'buses during the past year. The Corporation had now four, and it was proposed to increase the service to 12, at a cost of from £1,100 to £1,200 each. There was no opposition.

London.—Increase of Fares.—According to the *Evening News*, the extension of the 12½ per cent. bonus to tramway employés makes an increase of fares inevitable. In London alone the cost this year will be about £113,000, and many authorities are asking leave of the B. of T. to increase fares by 50 per cent.

We understand that Sir Albert Stanley has decided to ask a Select Committee of the House of Commons to consider the whole question. An official says that "some of the Council concerns will have to put the tramways on the rates this year, in spite of greatly increased traffic receipts, and, unless there is an increase of fares, the position will get worse from the ratepayer's point of view."

Manchester.—The Watch Committee has granted the request of the Tramways Committee to allow more passengers to stand in the cars, in view of the reduction of cars running owing to the shortage of staff. Instead of four passengers being allowed to stand in small cars and eight in large ones, permission is now given for 6 and 12 respectively.

Manchuria.—Electric Locomotives.—The 50-ton electric locomotives for use by the Fushun collieries for freight handling are the first of the kind ever built at the South Manchuria railway workshops. They are for the standard gauge. Each locomotive is designed to haul 580-ton trains at a speed of 12·9 miles per hour on the level tangent track, exclusive of the weight of the locomotive, the trolley voltage being 1,200 volts. They are of the two-bogie type, each bogie carrying 125-H.P. motors. The total weight is 97,200 lb.; ballast weight, 15,200 lb.; weight on drivers, 112,400 lb.; weight per driving axle, 28,100 lb.; and weight of a motor, 5,000 lb.—*U.S. Commerce Reports.*

Morecambe.—Electric 'Bus Service.—The Corporation has received Parliamentary sanction to its proposal to run an electric 'bus service. The scheme sanctioned was modified from that originally put forward, the proposed service through the areas of other authorities being dropped.

South Africa.—Johannesburg.—The chairman of the Tramways Committee has informed the T.C. that the cause of the recent failure of supply in the central area was due to a rat eating through the insulating material on a cable and causing a short circuit. He further warns the public that the tramways as well as lighting and power may fail at any moment should a breakdown occur. The power station is running at its maximum capacity, and extra plant, which is badly needed, cannot be secured, despite repeated requests to the Priority Committee and the Government.—*Cape Times.*

Southport.—By 31 votes to 20, the T.C. defeated a resolution which had for its object the rescinding of the running of Sunday tramcars by the Corporation.

Traffic Reductions.—The proposed reduction of tramway services by the Government is causing much concern in several Lancashire towns. The North of England is stated to be required to make only a 30 per cent. as against a 60 per cent. reduction in the south. In Liverpool, although the present service is below the pre-war standard, the number of passengers has increased by many millions per annum. In many cases a reduction in cars will mean a big increase in the cost of working, and may wipe out the possibility of any rate aid.

The situation is particularly difficult in seaside towns, where traffic depends largely for its success upon the summer season, and if this seasonal traffic is held to be unnecessary both the municipal and private undertakings will suffer severely.

TELEGRAPH AND TELEPHONE NOTES.

The Telegraph and Telephone Services.—A White Paper issued last week gives the report of the Auditor-General on the accounts of the telegraph and telephone services for the year ended March 31st, 1917, from which it appears that the gross receipts were £11,101,627, the net receipts £9,883,667, and value of services performed for other departments £3,332,209; the expenditure was £13,698,548, leaving a deficit of £482,672. Capital expenditure on telegraphs amounted to £10,867,644, the interest on which sum at 2½ per cent. came to £271,691, increasing the deficiency to £754,363. The capital expenditure on telephones amounted to £34,626,314, of which £9,606,293 had been redeemed, leaving a balance outstanding of £16,082,956, plus nearly 9 millions in respect of the purchase of the National Telephone Co.'s undertaking, &c.

The telegraph revenue for the year was £4.842,873, exceeding the expenditure by £576,800; allowing for interest on capital, pensions, depreciation, &c., there remained a deficiency of £529,639. The value of plant and stores at March 31st, 1917, amounted to £7,829,802.

The telephone service showed an income of £8,381,108, with a surplus of £3,407,206; after allowing for interest, pension liability, depreciation, &c., there was a net surplus of £201,729. The capital account showed a total of £27,022,029. On the exchange system there was a net profit of £239,112 and on the trunk system a deficiency of £37,383. Owing to war-time conditions many items in the accounts are partly estimated, and based on pre-war figures.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Dublin.—April 23rd. Electricity Supply Committee. Boiler house plant. See "Official Notices" April 12th.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyor, telpher, burners, steam piping, &c. See "Official Notices" to-day.

Newport (Mon.). — May 2nd. Electricity Department. E.H.T. and L.T. switchgear. See "Official Notices" to-day.

Plymouth.—April 29th. Corporation. Turbo-alternator, converter, transformers, and switchgear. See "Official Notices" April 12th.

CLOSED.

Bradford.—Electricity Committee :—

British-Thomson Houston Co., Ltd.—Three electrically-operated oil switches, for controlling existing 500-kw. motor-generators at Valley Road electricity works.

Glasgow.—Tramways Department of the T.C. :—

Commutators.—Mavor & Coulson, Ltd.

Electricity Department :—

Dick Kerr & Co., Ltd.—Repair of two 3,000-kw. turbine sets, (which have been in use at Port Dundas for over 14 years), £23,000.

Electromobile (Leeds) Co —One 5-ton electrical tipping vehicle, with lead battery, for removal of ashes from Dalmarnock generating station, £1,430.

On a report by the chief electrical engineer, the T.C. Electricity Committee remitted to him to endeavour to arrange with the present contractors for the supply of cables for the renewal of their contracts for another year, and to obtain and submit offers for the supply of other stores for the ensuing 12 months.

Winchester.—T.C. :—

Conversion of two boilers at the electricity works into one unit, with chain-grate stoker and superheater.—Babcock & Wilcox, Ltd., £900, (subject to priority certificate).

Balancer.—Vickers, Ltd.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 19th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Pneumatic Tools," by Mr. C. T. Orme.

Saturday, April 20th. At 6.15 p.m. At the Holborn Restaurant. Annual Reunion of Past and Present Officers.

Friday, April 26th. Paper on "Refrigerating Chambers and Heat Insulation," by Mr. C. H. Schroth.

Institution of Electrical Engineers.—Thursday, April 25th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Large Batteries for Power Purposes," by Mr. E. C. McKinnon.

(**Manchester Local Section**).—Tuesday, April 23rd. At 7 p.m. At the Engineers' Club. Annual general meeting. Address by the President.

(**Students' Section**).—Friday, April 26th. At 7 p.m. At University College, Gower Street, W.C. Paper on "Electric Arc Furnaces for Steel Refining," by Mr. J. A. Broughall.

NOTES.

Prince Lichnowsky's Disclosures.—We desire urgently to bring to the notice of our readers, and especially those among them who are leaders of opinion or moving among influential individuals, the pamphlet "Guilty," in which the National War Aims Committee has reprinted the astounding disclosures of Prince Lichnowsky, the German Ambassador in London from 1912 until the outbreak of war in 1914. The matter has been prepared by Mr. C. A. McCurdy, M.P. Three million copies of the pamphlet are being distributed by Messrs. W. H. Smith & Son, and it is most desirable that they should be widely circulated and read in our great industrial districts, and on the countryside as well. The disclosures strikingly set forth the true aims of Germany in "pressing for war" when our own statesmen were striving hard to preserve Peace, and they should be read by workers in our factories who are able to help win the war by accelerating production of essentials. The pamphlet should also be read by others, who will find in it grounds for encouragement in bearing the terrible sacrifices which they have to carry from the efforts of the Allies to defeat the debased intentions of Prussian militarism. If employers will let their wants be known to Messrs. W. H. Smith & Sons, at 186, Strand, W.C. 2, the number of copies required for their employés will be forwarded carriage paid.

War Allowances to Municipal "Old Bones."—In view of the Man-Power Bill, the Birmingham General Purposes Committee on Monday decided to recommend the City Council to increase the pay of men (employés) between 41 and 50 years who went into the Services, to the amount of their civil remuneration.

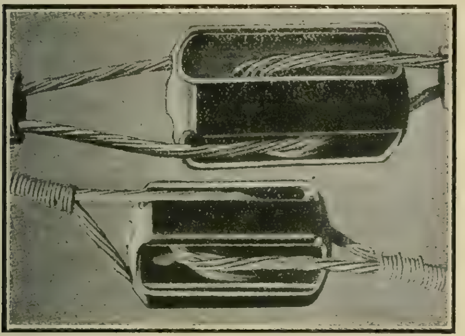
Science and Education.—The report of the Committee appointed to inquire into the position of natural science in the educational system of Great Britain was issued this week (Cd. 9,011, price 9d. net). It is a bulky document, comprising 86 pages. Amongst the principal conclusions are the following :—That natural science should be included in the general course of education of all up to the age of about 16; that real progress in education depends on a revolution in the public attitude towards the salaries of teachers and the importance of their training; that a large increase in the number of scholarships at all stages of education is necessary; that the elements of natural science should be a necessary subject in the entrance examinations of public schools; that more attention should be directed to those aspects of the sciences which bear directly on the objects and experiences of every-day life; that there are strong educational reasons for the adoption of the metric system; that stress should be laid on the accurate use of the English language; that those specialising in science should continue some literary study; that in the First School Examination all candidates should be required to satisfy the examiners both in mathematics and in natural science; that it is essential that salaries and prospects of teachers in secondary schools and technical schools should be substantially improved, and a national pension scheme provided; that increased attention should be given to instruction in science in elementary schools and in technical schools and institutions of all grades; that many more scholarships are needed to enable technical students to pass from junior to senior technical schools and on to the universities; that a thorough and practical training in mathematics and science is essential to the school education of engineers; that steps should be taken to secure the services of scientific men in the Home and India Civil Service, and that all candidates for the competitive examinations should supply evidence of a continuous course of training in science extending over several years; that various reforms should be introduced into the regulations of the universities, which should also receive large grants from public funds to equip them for their work in pure and applied science, and to enable them to reduce their fees; and that scholarships at schools and universities should be greatly improved in various respects.

New Scottish Electrical Association. — Councillors Morton and Willock, along with the engineer, have been appointed to represent the electricity department of the Glasgow T.C. at a meeting relative to the Scottish Municipal Electrical Engineers' Association, in Edinburgh, with instructions to support the principle that the new proposed Scottish Association should be a branch of the Incorporated Municipal Electrical Association, and not an independent Association.

Linking-up in the United States.—In the *Electrical World* of March 2nd a map of the State of Massachusetts is given, showing how far the process of interconnection of generating stations has been carried. It is recognised as an economic movement of great importance as a means of saving fuel and power. As an example, a transmission line will be completed in the near future between the turbine station of the Narragansett Electric Lighting Co. at Providence, R.I., and the plant of the Attleboro Steam and Electric Co. at Attleboro, Mass. The generating capacity of the Attleboro company's station is 3,000 kw.; the peak load is about 1,900 kw., and the company would be obliged to expend $630,000 within the next 20 years to meet its increasing business if this were done by progressively enlarging its own station. The present cost of production is about 1·13 cents per kw.-hour. Negotiations with the Narragansett company led to an agreement for the purchase of energy from the Providence tidewater station and for the construction of a 35,000-volt transmission line between the systems of the two companies. The total length of the line is about 12 miles (19·3 km.). For all energy supplied the Attleboro company is to pay the Narragansett company at the rate of 8·57 mills per kw.-hour, measured on the secondary side of the transformers in the Attleboro plant, with an adjustment for coal price variation and for any energy produced by other means than coal. The agreement, which has a life of 20 years from May, 1917, provides for the retention and maintenance of the turbine-driven units of the Attleboro company in the station of the latter, so that energy may be supplied reciprocally to the Narragansett company whenever necessary.

Waste of Paper.—Readers who come across instances of waste of paper should communicate by letter with the Paper Controller, 23, Buckingham Gate, S.W.

The Proper Installation of Strain Insulators in Guys.—In making up strain insulators in guys, particularly where large insulators and three-bolt guy clamps are used, care must be taken to place the clamps close to the insulators if the full strength of the guy cable is to be developed. A number of samples were recently tested for tensile strength; the edges of the clamps were set about 3 in. from the end of the insulator, as appeared to be customary with the linemen making up the samples. It was found that in every case slippage occurred at from one-half to three-quarters of the full strength of the guy, first one clamp and then the other slipping down to within 1 in. to ¾ in. of the face of the insulator, after which each would hold and the sample would develop the full strength of the guy cable.



Upper Figure: Clamp on Right has Slipped.
Lower Figure: Spliced-in Insulator after both Splices have Slipped.

A good specification covering this point is to make sure that the space between the insulator and the clamp (or wrapped splice if used) does not exceed 1 in.

With respect to the relative values of three-bolt clamps as compared with wrapped splices, the tests indicated that the use of clamps increased the ultimate strength from 15 to 20 per cent., although in all cases the samples, whether made up with or without clamps, exceeded the rating of the steel cables.—*Electrical World.*

Machinery Depreciation and Obsolescence.—The *Birmingham Daily Post* states that a memorandum by the Board of Inland Revenue on the subject of allowances for income-tax for wear and tear and obsolescence of plant and machinery was issued on Monday.

"It states that the existing law authorises a deduction in assessing profits of an amount the Commissioners may think reasonable as representing diminished value by reason of wear and tear. Definite rates of depreciation have been agreed upon in a number of important industries, but, with the exception of motor-omnibuses and sawmilling, these were fixed under pre-war conditions. Cases, however, have arisen, especially since the commencement of the war, in which machinery is suffering exceptional wear and tear owing, for example, to extra hours of running, the difficulty of obtaining material for effecting repairs, the rougher usage to which the machinery is subjected owing to the employment of unskilled labour, and the fewer opportunities available for having the machinery overhauled. In such cases applications for special rates of depreciation are entertained, but, generally speaking, the circumstances of individual cases are found to vary so widely as to render it impracticable to fix a uniform scale, and each application is dealt with on its own merits.

"In addition, there has been in operation since 1897 an allowance for obsolescence, and where new and improved machinery is introduced in place of machinery not wholly worn out the Board of Inland Revenue agrees to the allowance as a deduction from the profits of the year of so much of the cost of replacement as is equivalent to the written-down value of the machinery replaced, less any sum realised by the sale of it—the balance of the cost of the new machinery being treated as an addition to the capital of the business. As an alternative to these allowances, the cost of renewing the plant and machinery may be claimed as a deduction in the computation of income-tax liability under Schedule D. When this course is preferred, the amount to be allowed is the actual cost of the new plant and machinery (excluding any part of such cost which is attributable to additions or improvements—*i.e.*, to increase in capital) after deducting the scrap value or realised price of the plant and machinery replaced. Buildings and wasting assets, such as mines, annuities, and leasehold interests, do not come within the scope of the allowance for depreciation. In one class of case—namely, concerns which are 'controlled'—the income-tax allowance has been temporarily extended. This allowance prevents the hardship that would otherwise arise owing to the circumstance that controlled establishments, being held at the disposal of the Government, may be required to alter completely the course of their business and to undertake exceptional expenditure which may be of little or no post-war utility to them. The Finance Acts of 1916 and 1917 accordingly authorise the Commissioners to revise the allowance so as to allow a deduction to be made from profits of the difference between cost and post-war value of installations and extensions (including buildings) which would not have been undertaken but for the war and the express requirements of the Government."

Appointments Vacant.—Engineer-in-charge, also platelayer, for the Northampton Corporation tramways; mains jointer, for the Farnworth U.D.C. Electricity Department; meter superintendent (63s.), for the Loughborough Corporation Electricity Works; relief charge hand (56s. 3d.), for the Coventry Corporation Tramways Department; sub-station attendant, engine-room assistant, crane and telpher driver, and motor attendant, for the Stepney B.C. Electricity Works; jointer-electrician, for the Todmorden Corporation Electricity Department; charge engineer (70s.), for the Wakefield Corporation Electricity Works; charge engineer (67s. 6d.) for the Borough of Bedford Electricity Department; charge engineer for the Dover Corporation Electricity Works. See our advertisement pages to-day.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the annual meeting of the Scottish Local Section, the annual report submitted by the hon. sec. (Mr. Joseph Taylor) showed that during the session the Section was asked to assist in the raising of the City of Glasgow Company Volunteer Engineers (Scottish Command) Signal Company. A Sub-Committee was appointed, the cordial co-operation of the Electrical Contractors' Association was obtained, and a joint Special Sub-Committee was formed—Mr. E. Goslin, one of the members of the Section, having accepted command of the company with the rank of Major. A circular was issued inviting financial assistance, and the Committee acknowledged a generous response. The session ended with a total membership of 546, a reduction of about 2 per cent. on the previous year, while the average number present at the ordinary meetings was 61—*i.e.*, 19 per cent. of the membership. Major Hardiman, in charge of Signalling in Scotland was present, and appealed for Volunteers for the company; those present pledged themselves to assist as far as possible in raising the Signalling Company.

Birmingham and District Electric Club.—At a meeting on Saturday, Mr. J. J. Richardson presiding, a paper on "Electroculture" was read by Mr. V. J. Hill.

Fatality.—A verdict of "Accidental death" was returned at an inquest, at Barrow-in-Furness, on Jane Mill Jones (29), a machine cleaner at the shipyard. She was walking in the shop, trailing a shovel behind her, when the implement touched an electric wire. There was an explosion, and in a moment the woman was in flames. The jury suggested better protection in future for the electric wires.

Mobilising Niagara to Aid Civilisation.—In the *Electrical World* of February 23rd, Dr. Charles P. Steinmetz discusses the utilisation of the Falls of Niagara in the light of the unprecedented and acute shortage of power which now confronts Americans, and threatens seriously to interfere with the efficient prosecution of the war.

He says that in the discussion of the development of Niagara's power *versus* the preservation of the natural beauty of the Falls, two features have to be recognised.

1. The Falls are doomed in any case, and sooner or later, with the increasing power demand of modern civilisation and increasing shortness of power, self-preservation will force us to use Niagara's power to the fullest extent; that is, let the Falls run dry.

2. It is too late to preserve the natural beauty of the Falls. That could have been done a hundred years ago; but not now, when there is no place at or around the cataract where one's sense for Nature's wild beauty is not offended by the sight of some ugly modern hotel, some tower, or steel bridge.

About 15 years ago he proposed a plan which, while using the full power of the Falls, would preserve their beauty to the sightseer. At that time the suggestion was not taken seriously—the demand for power was not then so urgent as to-day.

"Suppose we permit the complete development of Niagara's 10,000,000 kw., more or less, for electrical purposes, let the Falls run dry, but on every holiday and Sunday have the power houses shut down, the power consumption reduced to the minimum possible—say, 10 per cent. of the full capacity—and so have the Falls running again in their ancient grandeur. We could thus satisfy the demands of modern industry, and, at the same time, satisfy the lovers of Nature; and, more than that, we would then see a sight which can be seen nowhere in the world—the starting of the Falls, when on Sunday morning the water would first begin to trickle over the bare cliffs and then gradually rise to be the giant Falls of old."

Electric Light Switching Examinations.—We regret to learn from Messrs. Lundberg that, owing to the illness of the examiner (Mr. W. Perren Maycock), who has just undergone a serious operation, considerable time must elapse before the examination can take place of answers to the last papers of questions set by him in electric light switching under their scheme.

In view of the personal interest Mr. Maycock has taken during the past five years in all those who have entrusted to his decision their efforts at solving the test questions set from time to time, we are sure that they will join us and Messrs. Lundberg in the hope of a successful removal of his trouble and a speedy return to health.

Industrial Reconstruction Council.—A public meeting, under the auspices of this Council, was held on Monday evening in Birmingham Town Hall. Dr. Addison was the principal speaker. The Lord Mayor presided.

Fuel Economy by Saving Electricity.—The decree of the Coal Controller that all consumers of electricity or gas above a certain minimum shall reduce their consumption by one-sixth, has, naturally, occupied the attention of supply engineers, some of whom have taken steps to assist their clients to comply with the requirement.

Mr. Harry L. Cottam, engineer and manager of the Horsham U.D.C. electricity works, has sent us a leaflet, of which he is distributing copies to his consumers. He remarks that :—

"At a time like the present it behoves every station engineer to loyally support any Government measure having for its objective a reduction in the consumption of coal, with a consequent alleviation of the congestion of traffic. It is with a certain amount of professional reluctance that station engineers view all restrictions which tend to reduce output, but these restrictions and curtailments are necessary from the broad standpoint of the nation's welfare, and should be cheerfully supported by every supply engineer, however detrimentally these restrictions may affect his balance-sheet."

The leaflet contains amongst others the following :—

"*Hints on the Economical Use of Electricity.*—Use metallic-filament lamps throughout the house. Carbon-filament lamps take about 3½ *times* the current of a metallic-filament lamp of equal candle-power.

"Immediately a lamp begins to blacken it is a sign that the useful life of the lamp is over. You can test this by holding a sheet of white paper behind the lamp. If the lamp looks black, either scrap it altogether, or relegate it to the bathroom, hall, or wherever you only use a light intermittently.

"A black lamp takes *more current* and gives *less light*

"Never buy lamps which are unstamped. You are safe in buying Osram, Royal Ediswan, Mazda, and other well-known makes.

"Remember that the ordinary domestic electric iron consumes as much current as 10 30-watt lamps."

Similarly, the Suffolk Electricity Supply Co., Stowmarket (Mr. Napier Prentice, managing director), has drafted a circular calling attention to the order, which begins :—"TURN OFF THE SWITCH when not in use, and so SAVE COAL." Consumers are urged to see that their lamps and motors are the most efficient, and to apply to the company for free advice as to how to economise. The saving in coal effected by using electricity for cooking is pointed out, and the company offers to assist in the installation of electric cooking apparatus. Consumers are also advised to read their meters regularly. The principal feature of the circular is a statement, set out with bold type, that cooking for a family of ten with a coal fire from June, 1915, to June, 1916, consumed 4¾ tons of coal, whereas from June, 1916, to June, 1917, cooking by electricity, the coal consumed (at the electricity works) amounted to only 1¾ tons, showing a saving of 63 per cent. Similarly in a household of seven persons, the substitution of electric for coal cooking in 1917 resulted in a saving for 12 months of 64 per cent. Other examples showing the saving of meat, as demonstrated at an hotel in 1912, are quoted.

The Association of Great Britain and France (Industry and Economics).—We are asked, and have pleasure in complying with the request, to give publicity to the following communication :—

Dear Sir,—We should be obliged if you would kindly allow us to bring before your readers the objects and position of the above Association.

The Association of Great Britain and France corresponds to its *confrère* "L'Association France-Grande-Bretagne" on the other side of the Channel, which was founded with a view to making better known among friendly countries the ideals, and specially the economic aims, of France, in order that true reciprocity, founded on mutual understanding, may be established.

The Association is a complement to the industrial side of many excellent societies which are already in existence or are being formed with the object of binding us closer to our French Allies.

Its work commenced in April last, and since that date the efforts of the Management Committee have naturally been directed to obtaining a strong nucleus of membership, and it now counts among its supporters some of the most prominent firms and Trade Associations in the kingdom.

It has been felt, however, that the time has come for the Association to have its own quarters and an independent organisation, in order to further its aims. It has been resolved, therefore, to appeal to that wider public of both men and women whose sympathies or interests are affected by the industrial, commercial, or agricultural intercourse of the two countries.

The subscription—two guineas—has been purposely kept low, and no entrance fee is charged, as it is felt to be of the first importance to collect a large and energetic body of members who will, at all events, lend their support, if they are unable to give their time and experience, for the common good of both countries.

All information regarding the Association may be obtained on application to the Secretary, Association of Great Britain and France, 39, St. James's Street, London, S.W. 1.

May we ask, through the hospitality of your columns, for a wide and prompt response to this appeal?—Yours faithfully,

(Signed) JAMES W. LOWTHER.
April 12th, 1918. (Signed) MOULTON.

Building Trades and the Bonus.—With reference to the note appearing on page 351 of our last issue under the heading "Manchester Electricity Works and the 12½ per cent. Bonus," it should be stated, by way of correction, that the application there referred to related to the building trades employés engaged in the Department, and to these alone. Manchester, in common with the majority of electricity supply undertakings, has already been paying the 12½ per cent. bonus under the Askwith Award to all workmen engaged in the Department, exclusive of those employed in the building trades. There were expressly excluded from the Askwith Award of March 22nd workmen such as building trade operatives, whose wages have customarily been regulated by the movements in the wages of the trades in which workmen of the same classes are ordinarily employed.

Electrical Power Engineers' Association.—Last week the members of the E.P.E.A. presented Mr. W. J. Ebben, late general secretary to the A.E.S.E., with a gold watch and cheque at a largely attended smoking concert at Anderton's Hotel, Fleet Street, E.C.

Mr. A. C. Bostel, Croydon, President of the Association, was in the chair, and said that, although Mr. Ebben had been unable to take an active part in the reorganised A.E.S.E., now the E.P.E.A., members were indebted to him for the founding and the survival of an organisation for station engineers which at an opportune time provided a most valuable nucleus. He was pleased to welcome that night so many new members from branches of the electrical industry other than the generation and distribution of energy, and said that the number of engineers, engaged with manufacturers, who had recently joined, would necessitate their representation on the executive.

With reference to the suggested British Electrical Engineers' Association, owing to a somewhat ambiguous note recently appearing in the Press, it had been wrongly inferred that the E.P.E.A. was in favour of the establishment of the new Association. The Council had never yet had an opportunity for discussing this, and he had attended the meetings of the Preliminary Committee, which was now disbanded, at the request of their hon. sec., Mr. Jones, who was a member *ex officio*, merely to safeguard the interests of the E.P.E.A.

They had just had reports of excellent progress from both the Midland and the Northern Divisions, and the E.P.E.A. was now past the realisation of the dreams of the pioneer of the A.E.S.E., their guest that evening.

Mr. Ebben, expressing his thanks to the donors, related several humorous incidents of early struggles, and congratulated the present organisers on the comparative ease of their work and their incomparable success.

A wealth of talent, musical and histrionic, was discovered among the members and their friends, and an enjoyable evening was spent. As a result of the concert, a donation of £10 will be handed to the Electrical Trades Benevolent Fund. Mr. F. B. O. Hawes, hon. sec., was present, and expressed his gratitude.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES' VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending April 28th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Monday, April 22nd.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, April 23rd.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, April 24th.—No. 1 Company, Drill, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, April 25th.—No. 2 Company, Drill, Knotting, &c., 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, April 26th.—Musketry, 5.30—8.

Saturday, April 27th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Sunday, April 28th.—Commandant's Parade at Waterloo Station, 8.45, for work at Esher. Marching Order, with rifles. Mid-day and tea rations to be carried.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Bonuses and Bacon.—Being editors whose physical fitness is of no great consequence to the State at the present crisis of our fate, because we are sedentary workers who only have to use our intellect, we confess to some jealousy of "the men engaged in bodily labour on electricity supply," for they are included in Class D by the Ministry of Food, and are thus allowed to consume more bacon than we are. They have our congratulations, and we crave their sympathies, as will also their Chiefs, we suppose. In some places, no doubt, even these may be expected to claim the extra bacon, just as they claimed the bonus—we wish them success! We have been deluged lately with such questions as this :—"Are we entitled to the 12½ per cent. bonus?" and presumably our letter-box will now ask us to decide where the line of "bodily labour" is to be drawn in the personnel of an electricity department. As matters stand at present, a difference of opinion respecting the bonus must arise between the parties before that question can be referred to the Committee on Production. But who will settle the difference of opinion in favour of those who want to spend their aforesaid bonus upon more bacon? Speaking generally, it would seem that he who has the bonus is also entitled to the bacon, for "unto him that hath shall be given."

Magnesium in U.S.A.—The cessation of supplies of magnesium from Germany sent the price up to a prohibitive figure in the United States, and led to its manufacture in that country. Comparatively large quantities are now produced, and the price is approaching pre-war values. In 1916 the output was 75,400 lb., and in 1917 it rose to 115,800 lb. The price fell from £1 per lb. early in 1916, to 7s. 8½d. late in 1917. The metal is a valuable aid in casting copper, brass, and bronze, and is largely alloyed with aluminium for aeroplane parts which must combine lightness with strength. It is also used for "flares."

Corrosion of Turbine Blades.—In *la Revue Générale de l'Electricité* for April 6th, Dr. Ch. Chorower gives particulars of the results of researches which he has conducted on the subject of the corrosion of turbine blades. He finds that this action is traceable to the presence of carbon dioxide in the steam, derived from the boiler feed water. He advocates the elimination of carbonates from the water by chemical purification, by which means he claims to have put an end to long-standing corrosion troubles in the power station of the Barcelona Electricity Co., and states that he has proved his theory to be correct by scientific tests made in the Lisbon electricity works.

Salaries of Tramway Managers and Electrical Engineers.—The following table of salaries paid to tramway managers and electrical engineers has been prepared by the York Council Electricity and Tramways Committee :—

—	Population of area of supply.	Electrical engineer.	Tramways manager.	Combined salary.	Increase since war.
		£	£	£	£
Blackburn	133,000	800	500	1,300	100
Derby	130,000	730			30
Coventry	130,000	900	700	1,600	150
Huddersfield	127,000	600	600	1,200	50
Southampton	126,000	600	—		No reply
South Shields	112,100	550	400	950	100
Wigan	110,000	600	400	1,000	200
Burnley	106,300	500	500	1,000	50
Halifax	101,000	800	—	—	100
Wolverhampton	95,000	800	500	1,300	200
Rochdale	94,700	500	500	1,000	100
Walsall	92,100	500	500	1,000	100
Newport	90,000	1,000	500	1,500	200
Paisley	85,000	450	1,000	1,450	200
Ilford	84,000	550	500	1,050	50
York.	84,000	400	150	550	
Leith	81,600	400	450	850	No reply.
Warrington	78,000	550	363	913	75
Ipswich	74,200	700	combined	700	Nil
Bath	70,000	600	600	1,200 + bonus	100
Blackpool	68,000	600	300	900	Nil
Darlington	65,700	700	combined	700	100
Bury, Lancs.	60,000	650	500	1,150	100
Luton	60,000	700			100
Lincoln	57,300	500		500	Nil
Great Yarmouth	55,900	500	250	750	Trams. stopped
Gloucester	55,000	600	—	—	100
Southport	51,000	400	300	700	50
Chesterfield	50,000	537/10/0	combined	537/10/0	37/10/0
Burton-on-Trent	48,000	500	265	765	65
Ashton-under-Lyne ..	45,200	500	310	810	160
Accrington	45,000	400	400	800	100

Decimal Coinage.—At the annual meeting of the Associated Chambers of Commerce held last week, a resolution was passed urging the Government to pass into law the Decimal Coinage Bill prepared by the Executive Council of the Associated Chambers of Commerce in conjunction with the Institute of Bankers and the Decimal Association. It is understood that Lord Southwark will introduce the Bill into Parliament at the earliest possible moment, and it is, therefore, incumbent upon everyone interested in decimal coinage to strengthen the hands of the Executive Committee, in order to demonstrate that the weight of public opinion is behind the movement.

Blackpool Linking-up Scheme.—In a preliminary report to the Electricity and Tramways Committee on the generation, transmission, and distribution of electricity for all domestic and industrial purposes within a 10-mile radius of Blackpool, Mr. Charles Furness, borough electrical engineer and tramway manager, says that the extension of the County Borough of Blackpool, now absorbing Bispham-with-Norbreck, will demand in the near future that the electricity supply shall be extended, and it is incumbent upon the Corporation to widen its sphere of influence. There should be no difficulty in the future of electricity generation and transmission being freed from a parochial policy.

The immediate question, so far as Blackpool is concerned, is the efficient administration of its own electricity undertaking. The late U.D.C. undertaking was a most expensive luxury, and will continue to be a burden for several years upon the Corporation finances. The position, therefore, is to continue for the present generating and distributing to existing consumers at 500/250 volts, but to make preparation for closing down entirely the gas plant, and realising upon it as soon as the L.G.B. removes the present restrictions as to capital expenditure, and the Ministry of Munitions withdraws its limitations upon the purchase of cables and materials. Unfortunately, the supply pressure at Bispham, being entirely different to that of Blackpool, necessitates a change of meters, lamps, motors and accessories, which is estimated to cost £1,800. The further cost of linking-up the feeders and distributors with the Blackpool network is a distinct matter from that of bringing consumers into line, and as this question of feeder extensions is involved with the future policy of centralisation of generation, it will be necessary for the Corporation to determine its future policy in regard to electricity generation, taking a long view of the requirements of "Greater Blackpool" and the surrounding districts during, say, the next 15 years. Mr. Furness considers the time is now opportune for this question to receive the serious consideration of the Corporation and adjoining authorities, with a view to a conference to discuss fully the desirability, or otherwise, of establishing either one authority or a joint electricity board to control and administrate the generation and transmission over trunk feeders of all energy required within a radius of 10 miles of Blackpool. In this event, an E.H.T., three-phase, 50-cycle system would be adopted, at 6,600 volts or 8,000 volts, to meet the demands of the Fylde district, estimated at 37 million units per annum 15 years hence.

Centralisation of generation and transmission for the Fylde from one conveniently situated power house does not mean scrapping existing cables, motors, meters, &c., in the adjacent urban districts, as the E.H.T. supply through trunk mains would be converted in the several areas at the existing stations, or new sub-stations, by rotary converters to suit the existing networks and consumers' supply pressures.

Blackpool should approach the adjacent authorities with a view to a joint conference of representatives to consider the desirability of centralisation, and a provisional agreement, pending the preparation of a scheme, should be entered into on these lines :—"That no contract for extensions of generating plant (steam, gas or electric) be made by any of the Councils, or parties to this agreement, pending the consideration of a scheme of E.H.T. generation and transmission, and that no contribution towards the rates of any authority be made out of electricity funds in the meantime."

One of the fundamental clauses which should form the basis of any centralisation agreement would provide :—"That the controlling authority shall so administrate the generation and distribution of electricity that no profit shall be made for the purpose of benefiting the rates of any community, and that in the event of any surplus beyond a reasonable margin to meet contingencies being obtained, the price of electricity shall be adjusted to absorb the surplus profit."

A far greater benefit will be conferred upon the communities affected between Lytham and Fleetwood by low tariffs, than by a policy of fixed charges high enough to secure surplus funds for rate-aid purposes.

Mr. Furness hopes the views of municipal authorities within 20 miles of Preston will be ascertained with regard to the setting-up of a joint board, and he is prepared to co-operate with representatives of other municipalities and companies interested, with a view to finding its true application and limitations as regards this particular zone.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—At the last meeting of the Marylebone Borough Council, Ald. Duncan Watson announced, with very great regret, the resignation of Mr. Hugh Seabrook, the general manager of the electricity undertaking. Mr. Seabrook had been appointed to a position of national importance, where he would have scope for his energies and abilities such as he could not have in their undertaking, and he desired to be released as early as possible. The Electricity Committee had accepted his resignation with the greatest regret.

Mr. David Williams, traffic superintendent of the Bury Corporation tramways, has now resumed his duties, after considerable service in the Army, from which he was recently discharged after an accident.

Stretford U.D.C. has increased the salary of Mr. R. Rowland, the resident electrical engineer, from £360 to £385 per annum.

Mr. John Lloyd, on his retirement from the managership of the Southport & Birkdale Tramway Co., which has now been taken over by the Corporation, was last week presented with a clock by the members of the Southport Borough Police Force.

Oldham Town Council has accepted the resignation of Mr. Percy Priestley, tramway manager, who has been appointed deputy tramway manager at Liverpool. Mr. W. Chamberlain, joint electrical engineer of the Corporation, has been appointed Mr. Priestley's successor at £400 a year, rising by £50 a year to £500.

Mr. Alfred Greed, of Burnley, has received an appointment as meter superintendent to the Calcutta Electric Supply Corporation, Ltd., at £300 per annum, plus 10 per cent. war bonus and £40 per year living allowance, on a five years' agreement. In 1915 Mr. Greed, who was then mains assistant at the Dewsbury Corporation electricity works, enlisted in the Royal Engineers (Wireless Section), and served in Egypt and Salonika. In the latter place he contracted fever, and in November, 1916, was discharged from the Army. He returned to Dewsbury until October last year, when he went to Loughborough as mains assistant.

York T.C. has decided to increase the salary of the electrical engineer and tramway manager, Mr. Hame, by £100 a year to £650. The recommendation of a further annual increment of £50 to a maximum of £800 was not carried.

The Reading Council has increased the salary of Mr. J. M. Calder, chief assistant engineer to the tramway department, from £275 a year to £350.

General.—Mr. J. A. Blackwood has severed his connection with the Union Cable Co., Ltd. (managing director), and has joined the board of the Hackbridge Cable Co., Ltd.

The name of the Langdon Davies Electric Motor Co. has been changed to Brittain's Electric Motor Co. As Mr. Langdon-Davies has not been connected with the firm for some 12 years, Mr. Brittain, who is the sole proprietor, has decided to use his own name in the form indicated. The change in the business will be in name only, and all outstanding machine guarantees still hold good.

From the *London Gazette* Supplement, March 21st, 1918 :—Regular Forces :—Army Ordnance Dept., Temp. I.O.M., 2nd Class, and Hon. Capt. to be temp. I.O.M., 1st Class, and Hon. Major :—C. F. D. Suggate, M.C. (October 1st, 1917).

Mr. Alan E. L. Chorlton, C.B.E., has been appointed Assistant Controller of the Department of Aircraft Production, to deal with the supply and production of aero engines.

Mr. Allan Maclean, district manager for the Postal Telephones at Canterbury, on leaving to take up a similar position at Belfast, has been presented by the staff with a desk clock.

Mr. Harry W. Alexander, Director of Publicity, The Society for Electrical Development, New York, has resigned to take up other work. He organised and successfully directed the work of the local committees and the publicity and sales work of both "Electrical Prosperity Week, 1915," and "America's Electrical Week, 1916," campaigns. Mr. Alexander is succeeded by Mr. Roy B. Woolley, now in the Society's publicity and sales department.

Roll of Honour.—Second-Lieutenant R. P. Shaw, Machine Gun Corps, who was engaged in the electricity department of the Rochdale Corporation, has been killed in action.

At a meeting of the York City Council, last week, the Lord Mayor presented the insignia of the Order of the British Empire to Miss Edith Blanch Maw, telephone supervisor at York Post Office, and Miss Nellie Ena Palmer, an operator.

Private H. W. Addison, Royal Fusiliers, who was with the Edison Swan Electric Co., Ltd., Ponders End, has fallen in action.

Sapper H. Bird, R.E., who enlisted at the outbreak of war from the electrical department of the North Staffordshire Railway, has been killed in action.

Private W. Woods, killed in action, was employed by Messrs. Baxendale & Co., Ltd., Manchester.

Second-Lieutenant G. H. Howe, R.G.A., killed in action, was an electrical engineer in the employ of Messrs. Dick, Kerr and Co., Ltd., Preston, and had visited South America, South Africa, and Japan on behalf of the firm.

Private F. W. Cooke, Machine Gun Corps, who has died of wounds, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private A. Latham, Manchester Regiment, awarded the D.C.M. for capturing a German machine gun, has been wounded. He was an apprenticed electrical engineer before the war.

Private J. W. Wardell, Seaforth Highlanders, who has been wounded in action, was an employé at the Leeds City tramway power station.

Private H. W. Gray (22), R.A.M.C., formerly at the Birmingham electric supply department, was killed in action on March 21st.

Sergeant H. V. Richardson, R.A.M.C., who has died from wounds, was awarded the Military Medal in January last. He was in the employ of Messrs. I. Frankenburg & Sons, Ltd.

Signaller J. Whitehead, Lancs. Fusiliers, who has died of wounds, was employed by the Peel-Conner Telephone Works, Ltd., Manchester.

Private F. Horrocks, Machine Gun Corps, killed in action, was an employé of the Anchor Cable Co., Ltd.

Trooper L. Dicks, Surrey Yeomanry, formerly representative for Electrical Supplies Co., Ltd., has been seriously wounded in action.

Obituary.—Mr. T. J. Sheehan.—The death has occurred at Bridgeport, Conn., U.S.A., of Mr. T. J. Sheehan, formerly a well-known Dublin electrical engineer. He was associated with the rebellion movement of Easter Week, 1916, and is credited with having been assigned to seize the Central Telephone Exchange, a feat which was frustrated by the Military taking prompt possession of the building. When the insurrection had been suppressed it was found that Mr. Sheehan had disappeared, and he was supposed to have been killed by military fire, but later it transpired that he had escaped to America.

REVIEWS.

Continuous Current Motors and Control Apparatus. By W. Perren Maycock, M.I.E.E. London: Whittaker & Co. Pp. v. + 330. Price 6s. net.

In his new book on continuous-current motors, Mr. Perren Maycock has given us another addition to the very useful set of electrical handbooks which he has compiled. The title of the book indicates that its contents cover a wide ground, but Mr. Maycock has not attempted to deal with the designing of motors except in so far as this is necessary to the understanding of their control and operation. He defines the scope of the book in the preface, and within the limits stated therein he has covered the ground very thoroughly. As he states, the book deals with the elementary theory of the subject, with the behaviour of various types of motor and their suitability for specified purposes, the various systems of controlling them, and, finally, with their faults and troubles, and the methods of locating and remedying these defects when they occur.

Mr. Maycock is too old a hand at his work not to have written clearly and concisely under each of these headings. He explains his points well, and the book should prove of much value to all those for whom it is specially written—the prospective owner of motors, the consulting engineer, the contractor and operating engineer, and the student. There is no doubt that even the most experienced will find many useful points in the book, whilst the tyro will be able to follow the text and the diagrams with advantage.

A special word of praise is due to Mr. Harold Bishop, who is given recognition as being responsible for the blocks, and also to Mr. Edward Hughes for the preparation of diagrams. Both classes of illustration are admirable, and the absence of the ordinary stock blocks lifted straight out of makers' catalogues is refreshing in its novelty.

Where so much is praiseworthy it may be invidious to call attention to Mr. Maycock's proposals for abbreviating the descriptions of control apparatus, as detailed in Section 64 of the book. It may be their novelty that makes them seem unsatisfactory, but it must be confessed that to describe a starter as "Tsh (or c), Pl (or m), Ms, Oks, Dnvcb" seems to be rather a strain on one's mental capacity.

As a further point, we would suggest the possibility of answers being supplied to some of the examination papers. A student trying to deal with the questions can now see the correct solution where this is numerical. It is probable that he would find a very brief answer to other questions (in an appendix) of considerable help, particularly if this were supplemented by references to the paragraphs in the book which deal with the subject in question. This might, however, involve an undesirable expansion of the book.

Alternating-Current Electricity and its Applications to Industry. Second Course. By W. H. Timbie & H. H. Higbie. Pp. ix + 729. London: Chapman & Hall, Ltd. Price 13s. 6d. net.

The present volume is supplementary to the "First Course" text-book with a similar title by the same authors, and forms a useful addition to their excellent series of college text-books dealing with the technical applications of electricity, which are very well known and widely adopted in the high schools and technical colleges of the United States, and, to a less degree, in this country.

In connection with any attempt to assess the value of this latest volume from the point of view of the general reader, it is necessary to emphasise the point that it has been compiled with a definite and rather restricted purpose, namely, as a text-book for college students who are working through a "second course" in electrical engineering; it is, therefore, not merely a students' text-book, but a book prepared specially for students who have reached a particular stage in their studies. This stage would be, roughly, comparable with that of preparation for a pass degree in this country. Thus, it will be found that the arrangement and treatment adopted are not those of a book which can be regarded as very suitable for general reference, while, further, its convenience from the standpoint of the general reader is still further restricted by the circumstance that it is intentionally made supplementary to the "First Course" volume, to which frequent reference is made for explanations of general principles or elementary theory. It would, however, be unfair to convey the impression that the treatment in the volume before us is not, on the whole, fairly self-contained.

The first two chapters deal with the subject of alternators, and the treatment of rating, efficiency, regulation, and parallel operation is careful and clear. The interesting Morecroft diagrams of armature reaction are reproduced, but full advantage is not taken of the opportunity which they afford for bringing out the characteristic double frequency of these reactions. Indeed, we could have wished for some rather broader treatment and analysis of the reactions and reactance due to the armature currents, their common points, the distinction between them, and their relationship to the main flux of the machine and their exact effect upon it.

Two chapters follow devoted to the transformer in which the treatment is on the usual conventional lines, except that a specially full discussion is included of polyphase connections and the running of transformers in parallel, as well as the use of transformers for special purposes, *e.g.*, for voltage regulation and current transformation. Much very useful matter is included in this section.

This is followed by a chapter on short transmission and distributing lines, and a further chapter on long transmission lines. These chapters are more concise than most of the others, and give an elementary, but clear and useful, treatment of the subject, so far as this is possible without going beyond the use of simple vectors and elementary algebra. Some good illustrations of high-voltage lines and safety devices of modern construction are included, and a number of useful examples of calculation based on actual installations add materially to the value of these chapters.

The asynchronous motor is discussed fully, with numerous illustrative diagrams of actual performance. The explanations of the characteristics and behaviour of both polyphase and single-phase types of motor are based mainly on simple vector diagrams, and a more complete analysis than these diagrams suggest is not attempted. Single-phase commutator motors are included, and the principles upon which they operate are clearly explained, though only in general terms, with the addition of one or two curves showing actual performance.

The next chapter deals with synchronous motors, again on well-known lines, employing the usual vectorial constructions.

The final chapter is on converters and rectifiers, and includes a detailed description of the construction and operation of the mercury arc rectifier for single- and three-phase current, the vibrating rectifier, as constructed by the Westinghouse Electric & Manufacturing Co. and the General Electric Co., as well as the electrolytic rectifier composed of aluminium-lead cells. Although the rotary converter is discussed at very considerable length, and various devices for voltage regulating, boosting, &c., are described in detail, the motor-converter, which in this country has found a fairly wide application, is dismissed in a page and a half of general description, ending with the comment that "the objection to this arrangement is the greater initial cost and the low power factor at which the induction motor must operate on account of running at one-half synchronous speed." It would appear that the authors' acquaintanceship with the motor-converter has not been very intimate.

We may conclude this notice by giving some general observations on the book and its characteristics. It is a most painstaking and well-prepared volume, but the reviewer cannot withhold the opinion that a freer use of mathematical analysis to replace some of the rather lengthy reasoning would have made it more useful, as well as more easy to read for the majority of students who are likely to use it. Seeing that it is a "Second Course," one would have expected to find a more concise treatment of elementary principles, and in some cases a more complete analysis of the more complex problems. It seems difficult to justify the expansion of a two-year students' text-book over nearly 400 pages in the "First Course" followed by 729 pages in the "Second Course," in view of the comparatively limited field covered by these volumes on alternating-current electricity. There is, of course, a good deal of overlapping in the two volumes, which we think might easily have been avoided by another arrangement of the matter, and a more definite sequence.

Undoubtedly one of the really valuable characteristics which both volumes possess is the excellent series of numerical examples and exercises which are inserted at frequent intervals in the text and at the end of each chapter. To many lecturers the volumes would prove valuable for this alone.

The detailed summary in prominent type of the contents of each chapter is also a useful feature—in this case its value would be most appreciated by the student. The diagrams and illustrations are quite excellent, and the whole "get-up" of the book is admirable.

Thus, while the reviewer cannot point to any outstanding feature of originality in treatment or clearly marked superiority in method of presentation which would raise the authors' work above several other excellent books on the same subject, he can readily testify to its merits as a clear and competent presentation marked by exceptional care in its preparation, and affording an excellent guide to the student of electrical engineering whose mathematical attainments are not great, and who is not yet ready to digest the more advanced and specialised treatises.

Practical Electric Illumination. By Terrell Croft. London: Hill Publishing Co. Pp. 225. Price 10s. net.

At the outset it is difficult to understand why such a volume as the one now before us should have been written. There is, however, useful information contained in it, but, at the same time, it must be admitted that much of such information can be consulted within the pages of an up-to-date electrical pocket-book. The first pages explain in a very elementary manner light propagation and its effect upon the human eye; much outlined therein has but little bearing upon subsequent matter, so far as the practical man is concerned, and Mr. Croft would, in our opinion, have made a better impression if he had assumed that his readers possessed a certain knowledge of the physical facts set forth; in later chapters a technical knowledge is assumed, so that the character of the book is changed, and it is in the concluding chapters that the most useful facts may be gleaned. Principles and units are treated of in the next chapter; here the author has certainly gone to considerable trouble, so that there should be no misconception as to his precise meaning, but the text becomes laboured, and repetitions are apparent. The following pages deal with reflection, and there appears but little noteworthy in this section. Regarding incandescent lamps information is very meagre, and one is repeatedly referred to another of the author's compilations. The subject of arc lamps appears to be handled in a better manner, and a few pages are devoted to other kinds of lighting units.

We now embark upon the principles of illumination design, but there is little here but what appears in some of the American manufacturers' catalogues or pocket-books. A similar comment also applies to the first portion of the chapter on internal illumination, but following adaptations from Mr. Clewell's work ("Industrial Lighting") is much that is fresh and serviceable. The pages applied to exterior illumination are in parts interesting, but their application to conditions in this country is limited. An exhaustive index completes the book, and, together with the large number of interesting diagrams, would appear to be its best point. The standard of excellence usually to be found in the books published by the Hill Publishing Co. is lacking. The constant reference to other publications by the same author is annoying, and the general presentation of the practical side is but superficial.

NEW COMPANIES REGISTERED.

Hubert Davies & Co., Ltd. (1,658F).—Particulars filed April 4th, 1918. Registered in Transvaal, December 20th, 1917, to take over a business formerly carried on at Johannesburg, Durban, and Cape Town, and at Salisbury, Rhodesia, and in London, as Hubert Davies & Co., and to carry on the business of electrical engineers and contractors, &c. Capital, £150,000 in £1 shares. British address: Salisbury House, E.C., where S. L. Crouch is authorised to accept service.

Gorey Gas, Water & Electric Supply Co., Ltd. (4,552).—Private company. Registered in Dublin on April 3rd, 1918. Capital, £3,000 in £1 shares. To take over the business of the Gorey Gas & Water Co., Ltd. (in liquidation). The subscribers are:—P. S. Hutchinson, Lynwood, Gorey, 1,000 shares; W. Armstrong, Enniscorthy, Co. Wexford, 500 shares; J. H. Armstrong, Enniscorthy, Co. Wexford, 500 shares. The first directors are:—P. S. Hutchinson, W. Armstrong, and J. H. Armstrong. Registered office: Esmonde Street, Gorey, Co. Wexford.

Sykes-Morris Submarine Acoustics, Ltd. (150,105).—Private company. Registered April 9th. Capital, £8,000 in £1 shares. To acquire patents, brevets d'invention, licences, concessions, and the like, &c. The subscribers (each with 10 shares) are:—A. F. Sykes, B.Sc., A.M.I.E.E., Lorne Villa, New Barnet, Herts., electrical engineer; J. T. MacGregor-Morris, 3, Lyndhurst Road, Hampstead, N.W. 3, electrical engineer; N. A. Piercy, B.Sc., A.B.Ac.S., 3, King's Bench Walk, Temple, E.C., aeronautical engineer; G. D. West, M.Sc., 105, The Drive, Fulham, S.W. 6; O. K. Morris, Ph.D., M.I.E.E., 14, Waverley Road, Kenilworth, electrical engineer; E. C. Crisswell, Willoughby House, New Barnet, motor agent. The subscribers are to appoint the first directors. Registered office: Lorne Villa, New Barnet, Herts.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brazil, Straker & Co., Ltd.—Memorandum of satisfaction in full on September 26th, 1916, of mortgage dated January 19th, 1916, securing £10,000, has been filed. (Notice filed March 28th, 1918.)

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Acknowledgment of indebtedness, dated March 14th, 1918, to secure £187,500, ranking *pari passu* with existing issued first mortgage debenture stock, making the total authorised issue £1,042,000.

Maxim Lamp Works, Ltd.—Memorandum of satisfaction in full on March 21st, 1918, of debentures dated 1915, securing £1,500, has been filed.

British Mica Co., Ltd. (72,187).—Capital, £5,000 in £1 shares (2,000 pref. and 3,000 ord). Return dated March 21st, 1918. 785 pref. and 2,194 ord. taken up; £979 paid on 785 pref. and 194 ord.; £2,000 considered as paid on 2,000 ord. Mortgages and charges: Nil.

City of Buenos Aires Tramways Co. (1904), Ltd.—Capital, £1,240,000 in 248,000 shares of £5 each. Return dated March 1st, 1918. All shares taken up; £1,240,000 paid. Mortgages and charges: £174,000.

Fisher, Humphries & Co., Ltd.—Mortgage, dated March 28th, 1918, to secure all moneys due or to become due from the company to Lloyd's Bank up to £200, in addition to costs, &c., charged on freehold Atlas Works, Walcott, Pershore, with fixed machinery and plant, &c.

Barbadoes Electric Supply Corporation, Ltd.—Issue on March 22nd, 1918, to secure £1,000, of which particulars have already been filed.

Sun Electrical Co., Ltd.—Memorandum of satisfaction to the extent of £275 on April 2nd, 1918, of debenture stock dated March 31st, 1911, securing £7,000, has been filed.

Electric Train-Lighting Syndicate, Ltd. (112,932).—Capital, £5,200 in £1 shares. Return dated February 12th, 1918. 5s. per share called up on 900; £225 paid; £4,300 considered as paid on 4,300. Mortgages and charges: Nil.

Harrow Electric Light & Power Co., Ltd. (44,529).—Capital, £50,000 in 6,667 ord. and 3,333 pref. shares of £1 each. Return dated March 12th, 1918. All shares taken up; £50,000 paid. Mortgages and charges: £25,000.

W. E. Dove & Co., Ltd. (72,630).—(Originally known as F. W. Murray, Ltd. Re-named in 1903.) Capital, £3,500 in £10 shares. Return dated March 14th, 1918. 320 shares taken up; £2,000 paid on 200 shares; £1,200 considered as paid on 120 shares. Mortgages and charges: £800.

Electrical Distribution of Yorkshire, Ltd. (84,972).—Capital, £50,000 in £1 shares. Return dated March 12th, 1918. 45,634 shares taken up; £45,634 paid. Mortgages and charges: £5,000.

Harpin & Co., Ltd. (109,290).—Capital, £2,500 in 1,500 pref. and 1,000 ord. shares of £1 each. Return dated December 14th, 1917. £977 paid; £525 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Electro-Bleach and By-Products, Ltd.—For 1917 the profit, after charging repairs, depreciation, directors' remuneration, bonus to employés, income-tax, and excess profits duty, was £25,902, plus £1,076 brought forward, making £26,978. After charging debenture interest and sinking fund and paying the dividend on the preference shares (7 per cent) 10 per cent. is to be paid on the ordinary shares, leaving £7,670, out of which £6,000 is being placed to reserve, and £1,670 carried forward. For 1916 the dividend on the ordinary shares was 7 per cent.

Indo-European Telegraph Co., Ltd.—Final dividend, 22s. 6d. per share (making 7 per cent. for the year), free of tax, plus 30s. per share, free of tax.

Johnson & Phillips, Ltd.—Dividend, 7 per cent. per annum on the ordinary shares, free of tax, carrying forward £13,565.

Direct United States Cable Co., Ltd.—Final dividend, 2s. per share, less tax, making 4 per cent. for the year.

British Engine, Boiler & Electrical Insurance Co., Ltd.—At the annual meeting, in Manchester, Mr. R. Charles Longridge said that the results of the year had been satisfactory. There had been a marked development in the business of the company, the inspection fees and premiums having increased to £141,875, as against £125,851 in the previous year. The explanation of this increase was that a very large amount of additional electrical plant had been insured with the company in order that the owners might have the benefit of the company's inspection service. Many firms had candidly told the company that whilst in the past they had been prepared to run their own risks, they now felt that with plant in charge of insufficiently experienced workpeople it was desirable to take the precaution of having it under independent inspection with a view to preventing stoppages. Other clients had been much impressed by the increased cost of effecting repairs, and were also influenced by the fact that it was an advantage in the event of a breakdown to have the assistance of the company's engineers, both in deciding what repairs should be carried out and in attending at the repairing shops to see that the work was satisfactorily completed.

Vickers, Ltd.—Final dividend, 1s. 6d. per share on the ordinary shares, making 12½ per cent., free of tax, for the year, as in 1916.

Marconi Wireless Telegraph Co. of America.—The net profits for 1917 were, after utilising $162,819 for reserves, $617,772, an increase of 138 per cent. Dividend 5 per cent.

Anglo-American Telegraph Co., Ltd.—Interim dividend for March quarter, 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income tax.

STOCKS AND SHARES.

Tuesday Evening.

Although the date of the Budget's introduction has been postponed, there is still plenty of reason for the quietude which continues to prevail in Stock Exchange markets. The news from the Western Front, added to the uncertainties respecting the Man-Power Bill, are quite sufficient to give pause to anyone with money to spend, while, on the other hand, the latter consideration is certainly at work in causing men from 41 to 45 to close down commitments as far as they possibly can, weeding out investments which they do not regard as suitable for a permanency, and doing what they can to keep their assets as liquid as possible. Prices on the whole are well maintained, but, of course, there is little business doing, and it is somewhat surprising that markets should hold up as well as they do in the face of the considerations just advanced.

The full returns of the London electric supply companies are now available, and taken in bulk they are distinctly satisfactory. Eight of the London companies have increased their dividends, and the Charing Cross is the only one amongst the Londoners which shows a reduction, the dividend in this case having been lowered from 5 per cent. to 4 per cent. The net revenue of the 13 principal undertakings has increased by nearly 8 per cent. More money has been put aside for depreciation and reserve. Gross revenue went up by 12½ per cent. as compared with 1916, but it must be immediately added that expenses increased by 15¼ per cent., the three main increases being in coal, wages, and distribution. Where the companies have scored in several instances is in connection with their power business. They have increased their charges to customers without causing any noticeable diminution in the amount of current sold. Some of them are now talking about putting up the rate still more, although the figures given in the reports of these 13 same companies scarcely seem to justify an advance at present. At the present market prices our tables show that yields ranging from 5¾ to 8 per cent. are available from ordinary and preference shares in this department, and the reason why business was so quiet during the months when other industrials commanded so much attention has to be sought simply in the fact that the supply of shares was extremely limited, and that prospective buyers tired of waiting for the opportunity to buy shares which very rarely came to market turned their cash into other directions.

The news as to the fall of Bailleul brought about dulness in the home railway markets, and in this the Undergrounds joined. The Income Bonds of the Underground Electric Railways fell further to 77, and other stocks in the group were heavy

W. T. Henley's Telegraph Works has had a splendid year, as its report shows. Gross profit at £239,000 is £40,000 better than that of the previous twelvemonth, and the net profit of £134,000 has increased by £23,000. The carry forward of £112,000 is £42,000 up. The meeting for authorising the bonus distribution of shares is to be held this week. There is no change in the market quotation, and manufacturing shares as a whole keep steady. Electric Constructions improved to 25s., British Westinghouse Preference shed 3/16 to 50s.

Marconis are a weak spot at 3, and the Preference receded to 2½, Americans going back to 22s. in spite of satisfaction felt in regard to the dividend of 5 per cent. just declared on them. The weakness is sympathetic with the heavy tone prevailing through semi-speculative markets, and this has also brought about a fall of ⅛ in Oriental Telephones, reducing the price to 4. Telegraph stocks are steady, the only reactions being ⅛ in West India and Panama shares, ½ in Anglo-American preferred, and ⅛ in Globe preference. Prospects of a rise in the income-tax favour good prices for the cable stocks and shares, upon which dividends are at present distributed tax-free.

Mexico Tramway bonds are flat again, a fall of 2½ reducing the price to 30, but Monterey Fives at 29 are 2 points higher on the week. Foreigners generally are disposed to depression. Brazil Tractions fell 1 to 41, Anglo-Argentine Tramways Debenture stock is down to 65½, and British Columbia Deferred at 25½ is 2 points lower. Rubber shares are weaker. Another lively advance in the Cornish Tin group brought in profit-takers, and a sharp reaction took place from the best prices reached.

The 6 per cent. First Mortgage Debentures issued by the Tees Power Station Co., Ltd., can be picked up in the Stock Exchange at 3 discount, at which they seem reasonably cheap. The principal, interest, and sinking fund are payable by the Newcastle-upon-Tyne Electric Supply Co., Ltd. The parent company has paid dividends ranging from 5 per cent. to 8 per cent. during the past six years, the latter amount being distributed for 1917, and the security offered for the Tees power station is ample to cover the debentures.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price April 16, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅝xd	+ ½	£7 8 0
Charing Cross Ordinary ..	5	4	8½	—	5 14 4
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	5	8xd	+ ⅛	8 6 8
City of London	8	8	12⅜	—	6 9 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅝	—	6 11 0
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅜	—	6 10 8
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	8	4	3⅜	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	9	7	— ⅛	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Anglo-Am. Tel. Pref.	6	6	94	— ½	6 7 8
do. Def.	33/6	1¼	22¼	—	6 14 10
Chile Telephone	8	8	7⅜	—	5 8 4
Cuba Sub. Ord.	5	7	9½	—	*7 7 4
Eastern Extension	8	8	15¼	—	*5 5 0
Eastern Tel. Ord.	8	8	153½	—	*5 4 6
Globe Tel. and T. Ord.	7	7	14¼	—	*4 18 8
do. Pref. ..	6	6	9⅞	— ⅛	6 1 6
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	18	18	51½	—	6 6 8
Marconi	10	15	8	— ⅛	5 0 0
Oriental Telephone Ord. ..	10	10	4	— ⅛	2 10 0
United R. Plate Tel.	8	8	6 13/16	—	*5 17 8
West India and Pan.	6d.	6d.	1½	— ⅛	*8 6 8
Western Telegraph	7	8	15¼	—	*5 5 0

Home Rails.

Central London, Ord. Assented	4	4	61½	—	6 10 7
Metropolitan	1	1	20½	—	4 17 7
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	77	— ½	*5 4 0

Foreign Trams, &c.

	Dividend 1916.	Dividend 1916.	Price	Rise or fall	Yield
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2¾	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	65½	— ½	7 12 8
Brazil Tractions	4	4	41	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	52½	—	9 12 4
do. do. Preferred	Nil	Nil	32½	—	Nil
do. do. Deferred	Nil	Nil	25½	—2	Nil
do. do. Deb.	4½	4½	58	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	35	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—2½	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	86½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	8 5/16	—	4 10 4
British Aluminium Ord. ..	7	10	32/-	—	6 5 0
British Insulated Ord.	17½	20	8⅝	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2½	— 3/16	6 0 0
Callenders	20	20	17½	—	5 15 4
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8½	—	5 14 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	+ 1/16	6 0 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	20¼	—	4 18 9
Henley	25	25	19½	—	6 8 2
do. 4½ Pref.	4½	4½	3¾	—	6 12 2
India-Rubber	10	10	15¾	—	*6 7 0
Telegraph Con.	20	20	42	—	*5 18

* Dividends paid free of income-tax.

THE INSTITUTION OF ELECTRICAL ENGINEERS AND THE MEDICAL PROFESSION.

Judged from the standpoints of attendance and sustained interest, the joint meeting of the Institution of Electrical Engineers and the Electrical Section of the Royal Society of Medicine, which was held last week at the Cancer Hospital, Fulham Road, was a gratifying success. It was accompanied by an exhibition of modern British apparatus employed in radiology and electrotherapy, the inspection of which, unfortunately, was somewhat hampered by its popularity, and after the meeting the audience were invited to visit the splendidly-equipped radiographic departments of the hospital itself.

The meeting was preceded by the usual informal dinner, which, inaugurated on the initiative of the president, has already established itself in popular favour, and bids fair to become a permanent feature of the I.E.E. programme, while it incidentally provides convincing testimony to the merits of electric cooking, as practised by the Waterloo Restaurant, even under war-time conditions. Perhaps the most admirable feature of the function is the total suppression of oratory, the president introducing the one essential toast with the two necessary and sufficient monosyllables.

Opening the proceedings in the lecture theatre, Mr. Wordingham said that the occasion was characterised by three new departures: Since the Health Exhibition in the distant past, no papers on electromedical subjects had been read before the Institution; the reading of the papers was associated with an exhibition of apparatus, in which was included the finest collection of X-ray equipment in this country; and the meeting was being held away from the regular meeting place, amid unique surroundings. He paid a tribute of admiration to the magnificent services of the medical profession during the war, and expressed the indebtedness of the Institution to the authors, who, in spite of the heavy pressure of their duties, had found time to prepare most interesting papers.

The author of the first of these (Dr. E. P. Cumberbatch) is the medical officer in charge of the electrical department of St. Bartholomew's Hospital, and successor to the late Dr. Lewis Jones, the well-known pioneer in the applications of electricity to therapeutics. Only experts can fully appreciate the splendid work that has been accomplished during the war by the electrotherapeutic department of "Bart.'s" and other leading British hospitals; as Capt. G. W. C. Kaye pointed out in his presidential address to the Röntgen Society in November last—

> In the treatment of septic wounds and persistent sinuses, the most extraordinary success has resulted from a combination of X-ray and ultra-violet rays. Hyper-thyroidism or "soldier's heart," produced by over-action of the heart through nervous strain, has been successfully treated by X-rays and radium rays. . . . Of war injuries, quite one-half, if not more, are gun-shot wounds of the nerves with paralysis of the muscles. These cases are sent for electrical examination of the injured nerves and subsequent electrical treatment. . . . The diagnosis and treatment of cases of paralysis by electrical methods—such as the application of continuous and interrupted currents and condenser discharges—is being studied on a scale never before possible, and invaluable additions to our knowledge of the pathology of therapeutic methods have been made. . . Many cases of war wounds, more particularly those of the uncomplicated, but inert, type which refuse to heal, are treated electrically. Simple application of a direct current stimulates the process of repair, and sluggish wounds at once begin to heal. "Trench feet," which occurred in large numbers last winter, receive benefit by electrical treatment, some by ionisation, others by high-frequency treatment and diathermy. Electrical methods are also largely used in the softening of hard scars following extensive wounds, and causing impairment of movement and fixation of joints. Cases of shell-shock and neurasthenia, and other functional disorders of the nervous system . . . are now being cured in large numbers by electrical treatment.

Capt. Kaye also referred to the work of the many thousands of radiologists in the medical application of X-rays, and said that—

> "by their aid miracles are literally being wrought daily. The part which the X-ray has played in the present war has been a veritable triumph." The X-ray examination of wounds and injuries has become routine practice in the field as in the base hospitals; the X-ray is indispensable. "The X-ray detection of embedded bullet and shell fragments is now so certain as to be commonplace. Bullets and shrapnel are found and removed from any part of the body, even from the lung and brain or in the region of the heart. . . . The location of small foreign bodies near the eye, or actually in the eyeball, can be carried out to the hundredth of an inch. . . . The value of the X-rays in diagnosing chest complaints has been established again and again in this war" in connection particularly with incipient tuberculosis, and diseases of the teeth, and of the alimentary canal, and invaluable results have been obtained from shortening exposures, especially in heart and lung conditions.

"One of the most successful workers in this. and, indeed, all branches of radiography," said Capt. Kaye, "is our secretary, Dr. Knox." He went on to describe the wonderful results achieved by the X-rays in the repair of wounds by plastic surgery:—

> "lips are renewed, a new nose built up, eyelids replaced, cavities in the palate filled in, by this new grafting process. . . . The radiologist's part in such work is to render scar-tissues pliant, to depilate hair from the scalp and skin surfaces concerned, to render the flaps pliant and more adaptable to their new positions, and to stimulate generally the healing process in both flaps and bone. For these purposes he employs radiation treatment, either X-rays or radium rays. . . . The employment of radiations in this connection as an aid to surgery is real pioneer work."

It will be seen, therefcre, that the subjects of the papers are of the utmost importance to the welfare of our wounded comrades, and that the authors rank as experts of the highest standing not only in the application of these modern methods of electrotherapy, but also in the wide fields of investigation and research which are being so assiduously cultivated in our great hospitals, and the Institution is to be congratulated on being the medium for bringing their work before the electrical profession.

Unfortunately we can only give a brief abstract of Dr. Knox's paper, and are unable to reproduce the numerous and exceedingly interesting radiographs with which it was illustrated, but we may draw attention to the appeal which he repeatedly addressed to electrical engineers for their expert assistance in the development of a perfected single-impulse radiograph apparatus. The chief desideratum appears to be a means of producing a powerful discharge equivalent to a thick spark upwards of 12 in. in length—in fact, a small flash of lightning; but no doubt every detail of the apparatus is susceptible of improvement, and it is possible also that totally different methods of producing X-ray flashes, or photographing their revelations, remain to be discovered.

Diathermy: The Use of the Electrical Current to Raise the Temperature of the Body in the Treatment of Disease.

By E. P. Cumberbatch, B.M., M.R.C.P., M.A. (Oxon.),
Medical Officer in Charge, Electrical Department,
St. Bartholomew's Hospital.

(*Abstract of paper read before the* Institution of Electrical Engineers *and the* Royal Society of Medicine.)

Heat is a valuable therapeutic agent, and it has been used in the treatment of disease for centuries. In all the various methods that have been employed for the application of heat to the body, some object heated to a higher temperature than that of the body is placed either in direct contact with the skin or at some distance from it. In the first case the heat is imparted by conduction, in the second case by radiation.

In the most recent method heat is applied through the agency of an electric current (of special kind). When the current is passed through the body, part of the electrical energy is converted into heat as it overcomes the resistance of the tissues. There is, therefore, a rise of temperature of the parts traversed by the current. This method of applying heat to the body differs from all others in that it causes a rise of temperature of the deep-lying tissues, as well as those on the surface. The raising of the temperature of the tissues can modify their physiological processes, and exercise a therapeutic influence over them in cases of disease. Further, it is possible by means of the electrical current to raise their temperature to a degree sufficient to coagulate them, and so destroy their vitality. The name "diathermy" signifies the "through and through" heating which the electrical current brings about, in contrast with the "surface" heating or "epithermy" produced by other methods.

It is well known that the electric current possesses the power to stimulate the tissues of the body, especially the excitable tissues, viz., muscle and nerve. If the direct current is led through the skin by way of an electrode, 1 sq. in.

in area, a stinging pain is produced when it reaches a strength of 10 milliamperes, and the pain is unbearable with a strength of 15 milliamperes. To heat the skin appreciably a strength of 400 milliamperes would be required. An alternating current of low frequency would be equally unsuitable to produce diathermy, because it would cause violent and intolerable contraction of the muscles before it attained a density sufficient to develop heat. If, however, the frequency is increased to, say, 500,000 per second, the current will lose all power to stimulate the tissues whatever its strength or density. Such a current can be passed through the body and its density raised higher and higher, and no sensation will be felt other than that of heat. The limit of toleration of such a current is determined only by the degree of heat.

Such a high-frequency current will not produce the electrolytic changes in the skin and underlying tissues which a direct current, if applied with too great a density, is liable to bring about, with the formation of blisters and ulcers. The probable explanation is that the high-frequency current is unable to cause a migration of ions and the formation of new chemical compounds possessing caustic properties at the poles.

To produce a degree of diathermy sufficient for medical purposes, an apparatus that can give a current of 2½ to 3 amperes is required. The device known as the d'Arsonval transformer, consisting of a pair of Leyden jars, the outer coatings of which are connected by a stout wire solenoid, will provide a current of sufficiently high frequency of alternation. The current will, however, produce little or no diathermy because the oscillations are not sustained. The Leyden jars have a very small capacity, and the time which they take to discharge through the solenoid is exceedingly brief, viz., 1/50,000th of a second. During this period there is a train of high-frequency current oscillations. If the jars are charged from a large spark coil (as is usually the case when the d'Arsonval transformer is used for medical purposes) fitted with a mercury break which interrupts the primary circuit 100 times each second, the jars will be recharged the same number of times per second. There will, therefore, be during each 1/100th of a second a period of only 1/50,000th of a second occupied by oscillations. If a patient is connected to the ends of the solenoid for a period of 30 minutes, he receives the high-frequency current for only 3.6 seconds. Further, the Leyden jars are charged to an unnecessarily high voltage, while the current of discharge between the outer coatings of the jars reaches a strength of ½ ampere only, as measured by the hot-wire ammeter. A current of this strength, flowing for very brief periods with very long intermissions, cannot perceptibly heat the tissues. The modern diathermy machine has been constructed with the object of obtaining currents of sustained high-frequency oscillation and higher amperage, so that the tissues can be sufficiently heated.

In the modern diathermy machine high-frequency currents are obtained on the same principle as that embodied in the d'Arsonval transformer, but there are the following differences in construction. The condenser has a much larger capacity. In the machine exhibited, its capacity is 0.6 microfarad; it is made of sheets of metal separated by mica. It is charged from the main by way of a stationary transformer which raises the voltage of the current to 2,000. The charging current must be an alternating one. The condenser discharges across two very narrow air-gaps placed in series. The air-gaps lie between copper disks placed with their faces parallel and opposite to each other. The opposing faces, between which the sparks pass, are coated with silver. The width of each gap is ¼ millimetre. With a transformer of this kind, supplied by a current from the main, the condenser is recharged as soon as it is discharged, so that there are uninterrupted chains of high-frequency oscillations in the solenoid. The current which passes to the patient is taken from a second solenoid, the extremities of which are connected to the electrodes. When the latter are placed on the body, the voltage between them is probably less than 1,000. In most machines it is possible to connect one of the electrodes to some intermediate point along the secondary solenoid, so that a lower voltage can be obtained. A low voltage is advisable when it is desired to send the diathermy current across a narrower section of the body, *e.g.*, from the front to the back of the knee. Further variation can be effected by altering the distance between the primary and secondary high-frequency coils.

The spark-gap is the "sensitive spot," and the slightest alteration in the width of the gap will considerably lower the strength of the current passing to the patient. The current will also be diminished if the spark-gap becomes too hot. In some machines methylated spirit is allowed to pass slowly between the metal disks. It is decomposed by the sparks, and hydrogen is formed; this gas is a better conductor of heat than air. In other machines the air of the gap is replaced by coal gas, and the width of the gap can be adjusted while the machine is in operation. In others, a stream of air is directed over the metal disks by means of a fan.

If it is desired to raise the temperature of a part of the body a few degrees only, so that its vitality is not impaired, electrodes made of sheet metal are placed so as to include between them the part to be heated. They can be placed either in direct contact with the skin or with lint pads, soaked in strong salt solution, intervening. If the electrodes are not too small the density of the current passing between them will be low, and the parts lying between them will be not unduly heated.

If, however, it is desired to raise the temperature of any abnormal tissue, such as a growth, to a degree sufficient to kill it, one of the electrodes is reduced to the size of a disk or button ⅛ in. to ¼ in. in diameter. The current density will be very great in the region of this small electrode, and the heat will be sufficient to coagulate and destroy the tissue.

Of the uses to which diathermy has been put, two examples will be given. There is a very painful form of inflammation of the knee that is caused by the micro-organism known as the gonococcus. This organism thrives at the temperature of the body, but is very sensitive to a hotter surrounding, and it can be killed if the temperature is raised a few degrees. The knee joint can be heated through and through by the diathermy current, and the organism can in this way be killed.

Diathermy has proved to be a valuable method of treatment of cancer and other malignant growths. It raises their temperature till they are coagulated and destroyed *in situ*. The application of hot cautery instruments to the growth would simply burn the parts where contact was made, and the destruction would spread scarcely any distance below, because the tissue is a very bad conductor of heat. The tissue conducts the diathermy current, however, so that it is heated through and through, and coagulated *en masse*, right down to the region where the density of the current is just too low to produce a sufficient degree of heat. The blood vessels and lymphatics in the growth are sealed, thereby lessening the chances of dissemination.

Single-Impulse Radiography (Instantaneous): Its Limitations and Possibilities.

By Robert Knox, M.D., Director, Electrical and Radio-Therapeutic Department, Cancer Hospital, Brompton.

(*Abstract of paper read before the* Institution of Electrical Engineers *and the* Royal Society of Medicine.)

In the initial stages of radiography, radiograms were obtained by time exposures of considerable duration amounting to an hour or more. Ever since those days the tendency has been to shorten the time of exposure in order to obtain sharp detail in moving parts of the body, such as the thorax or abdomen. Limitations of output by induction coils, and inability on the part of the X-ray tube to withstand the effects of passing a heavy current through it, for a time placed instantaneous exposures of any practical value beyond reach.

The first serious attempt to produce apparatus capable of dealing satisfactorily with the single-impulse exposure was made by Klingelfuss, who in 1901, by means of a "break" voltage due to a sudden interruption of the primary current of an induction coil, produced a brilliant illumination in an X-ray tube, which was sufficiently powerful to give an exposure on a photographic plate,, the exposure time being a fraction of a second.

Drs. Albers Schönberg and Walter produced a sudden interruption of the primary current by quickly withdrawing a metal pin immersed in a quantity of mercury. An apparatus was constructed and placed upon the market, and a number of these installations are in use at the present time. A 7-in. parallel spark was about the maximum that this apparatus would give, and the exposure was roughly calculated at about 1/200 of a second. The drawback to this apparatus was the fact that the human element entered largely into the operating of the single-flash switch, and an exact repetition of the exposure could not be made with any degree of certainty.

Dessauer introduced into practice in 1909 an apparatus for obtaining instantaneous interruptions by means of a mercury switch in which a rod was suddenly withdrawn from the mercury by means of a spring. No uniform results could be obtained, and this led to Dessauer investigating a system for breaking the primary current by causing a thin wire to melt rapidly by an overload of current. The drawback to this method was the fact that exposures were not always of the same duration, due to inequalities in the wire used for the fuse.

The Siemens impulse process is based upon the utilisation of the impulse which is generated in the secondary windings of the coil when the primary current is suddenly commutated. The commutation of the primary current consists of two distinct processes, *i.e.*, breaking the current and making the same current, but in the opposite direction. During the first process a "break" voltage is generated, and during the second a "make" voltage. This "make" voltage is now in the same direction as the "break" voltage, owing to the current flowing in the reverse direction after commutation. Therefore, commutation causes two consecutive impulses to be developed which, however, combine in one impulse when the two processes occur rapidly, namely, in about 1/100th of a second, and the combined impulse is equal to the sum of the two impulses. Therefore, with one commutation a current double the effect due to the "break" voltage is obtained, and the same effect as with the former processes is obtained with the expenditure of a considerably smaller load on the primary of the induction coil.

In order to obtain this enhanced effect it was necessary for the "make" voltage to be equal to the "break" voltage, and to construct an automatic switch to serve as a commutator, so that the two impulses combined in one impulse without interruption.

Although it was a fairly simple matter to construct a switch to carry the large quantities of energy necessary for the safe commutation of the current, a further problem had to be considered in connection with the construction of the coil. One has to consider the fact that the number of primary turns necessary to obtain an intense magnetisation, and yet sufficiently small to produce an intense opening voltage, had such a large self-induction that the primary current and consequently the magnetisation of the iron only rise very slowly after the current has been commutated, and therefore the secondary "make" voltage assumes too low a value; but this difficulty was overcome by constructing the coil so that as a result of a small self-induction the magnetisation rose rapidly. Further, measures had to be taken in order to neutralise the various secondary phenomena noticeable in the process of commutation.

It will be understood that the commutation of the current through the primary of the coil must be preceded by the make of the current, and the commutation must naturally be followed by switching the current off, and as secondary electromotive forces are produced when switching on and off, and as these are opposed to the electromotive forces generated in the commutation, it is necessary, in order to protect the X-ray tube against inverse radiation, that the processes of switching on and off be carried out slowly. This is arranged for automatically by the single-impulse switch, so that it is impossible for the operator to produce inverse radiation in the tube by the introduction of the human element into the mechanical working of the switch.

The switch is operated by rotating a handwheel through about one-quarter of a revolution. The commutator is then automatically operated, and this is followed by the automatic resetting of the switch for a second or further number of exposures.

Originally an induction coil was used in connection with this form of single-impulse apparatus, but it has since been found that the transformer with a closed magnetic circuit is more suitable, and a combined apparatus has been constructed in conjunction with a high-tension rectifier, using the transformer in conjunction with this apparatus for ordinary work, and the single-impulse apparatus for its special purpose. This apparatus may be considered to be a universal apparatus capable of dealing with all work necessary in X-ray technique, *i.e.*, X-ray therapy, as well as radioscopy and radiography.

The combined apparatus referred to can be connected to a direct-current supply, and further developments have made it possible to construct an apparatus which can be directly connected to single-phase or three-phase alternating current. This is based on the idea of connecting the primary coil of the transformer to the alternating-current supply for a short time, and of impressing upon the tube the secondary voltage generated during this time, and rectifying it by means of a rectifier.

I have two different types of single-impulse apparatus under my care: (*a*) with a mercury dip interrupter, and (*b*) a Siemens single-flash coil outfit. These have been in constant and regular work, and have given most satisfactory results up to the limitations of their electrical capacity. It may be assumed that the secondary current in these exposures is in the neighbourhood of 200 milliamperes.

To ascertain the radiographic efficiency of these sets of apparatus, an extensive set of experiments was carried out. These experiments resolved themselves into an attempt to ascertain (1) the best conditions for working, (2) the testing of the uniformity of the discharge over a large number of exposures, and (3) the value of intensifier screens for use with single-flash exposures. A number of well-known X-ray plates were used in these experiments. It was also hoped that the experiments might lead to suggestions for improving the apparatus—to ascertain in fact the minimum output with which it would be possible to do all forms of radiographic work, and gradually to lead to a standardisation of exposures.

The apparatus was used with two forms of X-ray tubes, namely, (*a*) The gas tube, Macalister Wiggin tungsten target, and (*b*) the Coolidge tube.

The Coolidge tube is undoubtedly by far the best and most reliable tube to use for this class of work because of its great flexibility, its durability, and the great ease of manipulation which it allows. With one tube any number of exposures may be made with the tube emitting rays of varying penetration.

The analysis of these experiments shows a remarkable uniformity of the discharge, even when allowance is made for the possibility of photographic error.

The first desideratum is that the output should be powerful enough to give perfect radiographs without the use of the intensifier screens. Good though the plates obtained with the screen are, it would be a great help in technique if it could be dispensed with altogether; at present this cannot be done because the apparatus is not powerful enough. A consideration of the plates shown will prove this point. In all the exposures made at a distance of 1 ft., without an intensifier screen between the surface of the plate and the anticathode of the tube, the exposure is nearly a full one. This distance is impracticable except for very small parts. At a standard distance of 2 ft. the output requires to be increased at least four times, and for 3 ft. at least nine times. The latter is the better distance for standard work, but it may be advisable to work at a distance of 6 ft., in heart work especially.

Most, if not all, of the single-impulse work of the present day is done in combination with the intensifier screen; this is always used in thoracic and abdominal work. For all distances under 6 ft. a certain amount of distortion is produced according to the distance of the object from the plate. In practical work the distortion may be allowed for, but when accurate measurements of the heart are required the greater distance of 6 ft. would to a large extent do away with the distortion, and give the heart approximately its normal size on the plate.

Experiments lead us to the conclusion that we need an apparatus which will enable us to work satisfactorily at a distance of 6 ft. for these conditions. The solution of this problem I can confidently leave to the electrical engineer, and in time I hope to see realised the mammoth machine and the extraordinary results whch will automatically follow from its production.

Apparatus powerful enough to enable us to work efficiently at a distance of 6 ft. from the plate by the aid of intensifying screens for thoracic and abdominal work would also be powerful enough to allow of work being done on other parts at a distance of 2 ft. without the screen; then it should be possible to do all forms of radiographic work.

The great advantage over work which is now carried out by time exposures will be that there will be no plates spoiled by movement on the part of the patient.

No hospital which especially deals with children's diseases can afford to do without a single-flash apparatus. With a single-impulse machine we can allow a child to be upon the plate and move about—the exposure is made while the child is actually on the move—yet the picture obtained shows no trace of movement.

I am fully convinced that in the single-flash method we have the beginning of a standardisation of exposures, and when the apparatus at our command is more powerful than that of the present day I feel sure we shall have gone a long way towards the accomplishment of the standardisation of technique and exposure.

I feel confident that when we have explained our difficulties and are able to set forth accurately our requirements we shall be able to secure the co-operation of electrical engineers, and that the result should be the production of apparatus far in advance of anything in use at the present time.

Discussion.

Opening the discussion, Dr. F. W. **Metcalfe** said he had noticed the advantages of the method a considerable time ago; nine months before the war began he obtained an apparatus from Messrs. Siemens, and had been extremely pleased with it. In the course of four years' work, no repairs whatever were required. The apparatus, as stated by Dr. Knox, had its limitations. It was especially useful for observing the heart, which was always in movement, necessitating an absolutely instantaneous photograph. The use of the intensifying screen was necessary, to give stronger pictures, but some screens were rather rigid, and did not come into close apposition. The pictures were already good enough for diagnosis. There was no need to radiograph bones by the single-impulse method; it was better to give them longer exposures, but the stomach and intestines needed single-impulse radiography. It was certainly desirable to have the bulb at a distance from the patient. Manipulating the intensifying screen was a nuisance; what was wanted was an enormous machine without these limitations, without intensifying screens, which yet could produce a *standardised* picture of any part of the body which could be compared with other pictures.

Dr. **Warren** discussed the nature of diathermy, and argued that Dr. Cumberbatch was not dealing with diathermancy (heating through and through), but with heating *in* the substance, hence he named the process endothermy. He himself had used the process for some years with very good results, and he described various operations.

Mr. **Burnand** suggested the use of magnets and iron filings to enable the operator to visualise the path of the current in the body, and discussed the use of a number of electrodes simultaneously in diathermy; and another speaker described the method of photographing a bullet in motion.

DESCRIPTION OF EXHIBITS.

Messrs. Watson & Sons (Electromedical), Ltd., showed the core and primary winding of the single-flash coil in the unfinished condition, in order to give an idea of the dimensions of the iron employed in comparison with induction coils working with interrupters. There was also one section of the secondary winding, showing the method of insulation between the adjacent layers. These are wound on the well-known Leslie Miller system, each layer being wound horizontally on a paper disk, so that it is quite impossible for two points, between which there is very high potential difference, to come accidentally close to one another.

The single-flash switch was also shown; this item includes some intricate mechanism all working under oil, and is arranged slowly to build up the magnetisation of the iron core, and then suddenly interrupt the current, and immediately afterwards reverse so as to destroy all residual magnetism in the iron, and increase the rate of change of its magnetic condition. The secondary effect has now been produced, but current is still flowing in the primary winding, and it is necessary to reduce this, and finally break it, it being necessary to do this as slowly as possible, in order to prevent further induced effects in the secondary winding.

A mercury interrupter with a new type of rectifier was shown, in which instead of one rotating member, about 10 in. diameter, for the collection of the high-tension current, three smaller rotating pieces, about 3 in. diameter, mounted vertically one above the other, are arranged, all connected in series, so that the sum total of the air gaps introduced remains the same as before.

A high-frequency apparatus for working from an ordinary induction coil, re-designed in order to obtain extremely long sinuous discharges, and very great outputs, using an oil condenser with multiple spark-gap, was also shown.

A diathermy apparatus was exhibited, fitted with an improved spark gap in which the discharges take place in an atmosphere of coal gas; the mechanical construction is such that the adjustment of the width of this gap can be very nicely controlled, even while the current is passing. This is a very great advantage, as for varying body resistances it is really necessary to alter the width of gap in order to obtain the best results. The coal gas also contributes to the cooling of the gap, and there are no mica separators to need replacement.

There was also shown a small high-frequency attachment for ordinary medical applications, the frequency of which is such as to permit of the production of X-rays by means of one connection only to the cathode terminal of the X-ray tube.

The Hernaman-Johnson modification of the Lewis Jones condenser apparatus was shown in the electric treatment room under current.

The Cambridge Scientific Instrument Co., Ltd., had on view an electric bullet probe for locating foreign bodies, such as bullets or shell fragments, in wounds. The disadvantages of the telephone probe are overcome by this instrument, which is simple and self-contained, no battery or other accessories being required. The instrument consists of a fine metal probe and a contact wire of the same metal, both of which are connected by flexible leads to a galvanometer. The contact wire is placed on the edge of the wound in good contact with the tissues, and the probe employed in the usual way. Since the probe and contact are of the same metal there is no potential difference, and no deflection of the galvanometer when the probe is used. As soon, however, as it touches some other piece of metal in the wound a voltaic cell is formed, the metal constituting one pole and the contact in the edge of the wound the other, with the blood as the electrolyte. Consequently a current flows through the galvanometer and deflects the pointer.

Their exhibit also contained a number of electrocardiograms taken with the Cambridge electrocardiograph by Dr. Thomas Lewis, of University College Hospital Medical School, London, and illustrations of a special ward at the First Eastern General Hospital, Cambridge, in which wounds are treated by immersing the patient for days, or even weeks, in a bath of warm water, which is kept at constant temperature, and supplied with a stream of fresh water. The apparatus for regulating and registering the temperature of the water supply to the baths was installed by the Cambridge Scientific Instrument Co.

The Medical Supply Association exhibited their galvanosets, and Messrs. Alfred E. Dean also showed a collection of electromedical apparatus.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

KEDAH AND PERLIS.—By a Resolution passed by the Kedah State Council it was decided not to collect export duty on wolfram for one year from July 19th last.

The Perlis State Council passed a Resolution on August 6th last deciding to levy export duty on tin ore at 10 per cent. *ad valorem*, the value of tin ore being taken as 70 per cent. of the Penang price of tin from time to time.

SWEDEN.—The exportation of zinc ore has been prohibited as from October 18th.

JAPAN.—A Law, which came into force on September 1st, has been promulgated, having for its object the encouragement of the iron industry in Japan. Among other provisions to effect this purpose, the exemption from import duties of implements and machinery required for iron and steel works having a certain output is allowed. Such exemption is conditional upon a permit having previously been obtained from the Minister of Agriculture and Commerce, which permit must be annexed to the import declaration made when the goods are imported. A list of the goods which may be accorded duty-free admission under this law has been issued by the Department of Agriculture and Commerce; it includes electric furnaces and gas electric generators of not less than 500 H.P.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

5,584. "Device for electrical transmission of sound or speech to be fixed on talking machines." H. Okell. April 2nd.

5,585. "Portable stands for electric lamps." H. J. Furse & W. J. Furse and Co. April 2nd.

5,633. "Dynamo-electric machines." W. A. Price. April 2nd.

5,665. "Connectors for electric cables." E. Priddle. April 3rd.

5,712. "Audion or lamp relay or amplifying apparatus." M. Latour. April 3rd. (France, April 3rd, 1917.)

5,746. "Varying candle-power of electric lights." W. Henderson, and Telford, Crier & Mackay. April 4th.

5,749. "Ball-contact commutator hands." W. T. Forsselius. April 4th.

5,770. "Magnetos." J. B. Bushnell & W. S. Killingsworth. April 4th.

5,771. "Tee or branch joints of armoured electric cables." C. J. Beaver and E. A. Claremont. April 4th.

5,774. "Electric speed-controlling apparatus." V. Bibire. April 4th.

5,779. "Lanterns for gas-filled electric lamps." British Thomson-Houston Co. & H. C. Wheat. April 4th.

5,780. "Electric lamp fittings." H. C. Wheat & British Thomson-Houston Co. April 4th.

5,798. "Inductively-untappable telegraph." A. H. Morse. April 4th.

5,809. "Sparking plugs." Soc. Generale des Huiles et Fournitures Industrielles l'Oleo. April 4th. (France, October 4th, 1917.)

5,841. "Cooling electrical machinery, &c." H. A. Carney & H. M. Lacey. April 5th.

5,860. "Sound producing devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 5th.

5,862. "Means for cleaning sparking plugs." A. G. Knight. April 5th.

5,866. "Electrode holders." Aktieselskab Arendal Smelteverk. April 5th. (Norway, April 13th, 1917.)

5,867. "Electric accumulators." Sig. G. Marconi. April 5th. (Italy, April 5th, 1917.)

5,881. "Electric heaters." A. R. Huntingdon, R. G. Manifold & C. O. Poole. April 5th.

5,886/7. "Wireless telephone installations." L. N. Brillouin. April 5th. (France, October 8th, 1917.)

5,904. "Signalling device for colliery winding engines, &c." F. M. Brown. April 6th.

5,917. "Electric lamps." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 6th.

5,918. "Electrical measuring apparatus." Siemens & Halske Akt. Ges. April 6th. (Germany, March 27th, 1917.)

5,927. "Audion or lamp relay or amplifying apparatus." M. Latour. April 6th. (France, April 15th, 1916.)

5,932. "Internal-combustion engines, and ignition devices therefor." W. G. Ikin. April 6th.

5,936. "Electric accumulators." A. L. Davis. April 6th.

5,937. "Electric resistances." S. R. Mullard. April 6th.

PUBLISHED SPECIFICATIONS.

1914.

18,009. Sender for Hertzian Waves with Polyphase Generators. Bouchardon. August 1st, 1913.

1916.

The numbers in parentheses are those under which the specification will b printed and abridged, and all subsequent proceedings will be taken.

14,825. Voltage or Current Regulators for Dynamo-electric Generators A. J. Jullin. October 18th, 1916. (113,980.)

18,113. Galvanic Cells. R. Schuster. December 18th, 1916. (113,984.)

1917.

2,157. Systems of Control for Electric Motors Operating Cranes an analogous apparatus. W. H. Scott & J. Bentley. February 13th, 1917. (Cog nate application, 12,855/17.) (113,993.)

2,162. Electric Heaters. A. F. Berry. February 13th, 1917. (113,994.)

3,549. Disconnecting Boxes for Electric Cables. W. T. Henley's Tele graph Works Co. & E. Moor. March 10th, 1917. (114,009.)

3,579. Arrangement of one or more Inspection Glasses for Magneti Brakes. Naamlooze Venootschap Haarlemsche Machinefabriek Vorheen Geb Figee. March 14th, 1916. (104,872.)

3,581. Diaphragms for Galvanic Cells. R. Schuster. March 12th, 1917 (114,010.)

3,582. Diaphragms for Galvanic Cells. R. Schuster. March 12th, 1917 (114,011.)

3,584. Galvanic Primary Cells. R. Schuster. March 12th, 1917. (114,012.

3,618. Electromagnetic Switches for Train Lighting and similar Instal lations. J. Stone & Co. and A. H. Darker. (114,015.)

3,652. Electric Circuits linked by Relay or Repeater. W. H. Grinstead March 13th, 1917. (114,017.)

3,656. Intermediate Shunt for Aerial Ropeways and the like. R. W James (M. J. Cary, S. J. Hally & C. C. Stephen). March 13th, 1917 (114,019.)

3,664. Electric Switches. J. Stone & Co. and A. H. Darker. March 13th 1917. (114,020.)

3,665. Brush and Terminal Contact Mechanism of Dynamo-electri Machines. J. Stone & Co. and A. H. Darker. March 13th, 1917. (114,021

3,767. Brushes for Dynamo-electric Machinery. Troup, Curtis & Co. an J. H. Wickett. March 15th, 1917. (114,027.)

3,811. Crystalline or like Detectors for Electric Waves. H. Hur March 21st, 1916. (105,905.)

3,861. Electrical Thythmical Interruptors for Medical Use. W. F Schall. March 16th, 1917. (114,034.)

4,480. Electric Connections between Cells or Batteries and Bulbs o Electric Pocket Lamps, Electric Torches, and other Electric Lamps whic Carry their own Cells or Batteries. Efandem Co. & A. H. Williams March 28th, 1917. (114,048.)

5,112. Housing of Electrical Switchgear. Igranic Electric Co. & A. H Curtis. April 11th, 1917. (114,054.)

5,840. Shock Absorbers for Electric Batteries. F. N. Bossom & L. E Armstrong. April 25th, 1917. (114,063.)

6,894 Process of Electric Spot Welding. T. E. Murray. June 28th 1916. (107,758.)

8,854. Electric Locomotives. British Thomson-Houston Co. (General Ele tric Co., U.S.A.) June 20th, 1917. (114,077.)

THE

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OVERSEAS ENGINEERING TRADE.

As we foretold in a recent issue, the meeting of the Institution of Electrical Engineers at which Mr. Andrews's paper on "The Overseas Distribution of Engineering Appliances" was read and discussed was one of the most interesting and successful of the session. The author quickly read an abstract of his paper, and for over an hour and a half there was no slackening in the discussion, though, with the privileged exception of the first speaker, no one exceeded the time allowance of five minutes. The fact that so many of the speakers commenced by cordially congratulating the Institution on the reading of a paper dealing with a commercial question of the first importance—endorsing our own remarks of a fortnight ago—was highly significant, and we have no doubt that the Council will take due note of it.

While many divergent views were expressed in the course of the debate, on certain points there was a degree of unanimity which could not fail to impress the hearer. Chief of these was the subject of "State Control." It was made abundantly clear that the very name was anathema to the members, and that any scheme which involved the exercise of State control would stand condemned without trial on that account. The author had handled this subject very warily, setting forth the pros and cons, and in his conclusions he definitely rejected State control of industry "upon German lines," substituting for it "State service" on lines analogous to the postal service; but the discussion indicated that manufacturers would regard any form of State intervention with a very jealous eye, and that even the postal "service" was not immune from suspicion as a medium for despotic, though veiled, control by the State.

Secondly, there could be no doubt that the meeting almost unanimously approved, and even demanded, collective action, at any rate in connection with the overseas distribution of engineering goods; the position with regard to co-operation in production was not quite so clear, but certainly the consensus of opinion was generally in favour of it, and several speakers emphasised the necessity of reducing competition between manufacturers in similar lines by the adoption of a measure of co-ordination or specialisation within specified limits. Only by such means, it was urged, would it be possible for British manufacturers to cope with the gigantic organisations which have their roots in Germany and the United States, and of which the ramifications embrace the whole world—actually, as in the case of the former, or potentially, as in the case of the latter.

Another factor in the problem which received a good deal of attention was the question of the middle-man, whose popularity appeared to be a minus quantity; in this connection much criticism was directed at the intermediary "Board of Control" outlined by the author, and there was a decided disposition to "short-circuit" this body by direct communication between the producing and distributing organisations.

But all these questions are subordinate to what, in our opinion, was the real, solid outcome of the meeting—namely, the general feeling that the time for talking was past, and that the time had come for action. No one can tell when the war will end, but of one thing there can be no question—that there is not a day to spare in making and perfecting our preparations for the new peace conditions; not the *return* of peace conditions, for the old *régime* has gone for ever, and we shall face a new world. As Mr. Williams remarked, when peace returns "business as usual" will not serve; we must devise new methods and lay new plans in readiness for the industrial struggle which will then commence. Hence the question of the hour is what step shall be taken to bring the matter to a head, and to institute immediate action. Only one practical proposal to this end was put forward, namely, that of Capt. Slacke, that the Councils of the three great engineering Institutions should jointly approach the Overseas Trade Advisory Committee, the personnel of which had been announced on the same day, and secure its support; it is obvious that, apart from any question of "control" or "service," the cordial support of the Government is indispensable to the successful inauguration of any national scheme of the kind under discussion. If such combined action can be arranged, there can be no doubt that it will carry great weight with the Department of Overseas Trade, and its effect would be greatly increased by the co-operation of the B.E.A.M.A., whose sympathy may safely be relied upon, as well as representatives of other important bodies interested in the engineering industries. Any such movement must have a beginning, and the initial impetus might well be furnished by the appointment of a small committee by the Council of the I.E.E., to carry out the preliminary negotiations and arrangements with a view to the early formation of a widely representative committee charged with the duty of formulating a suitable constitution for the proposed organisation and securing its creation.

Granted that, as the meeting made manifest, some system of organised co-operative selling in oversea markets is essential to the development of the engineering export trade, and that such system, as the discussion also demonstrated, must be entirely free from State control, the question arises: What form should be given to the central organisation, which is obviously necessary to co-ordinate the efforts of the manufacturers and to satisfy the requirements of both producers and consumers? Several alternatives present themselves, besides the system at present mainly in vogue—namely, direct representation abroad by the manufacturing firm itself. In the absence of State intervention, this system will of necessity always remain open to all firms that are large enough, strong enough, and adequately equipped with a capable staff to undertake the wide range of duties involved; but obviously it will remain difficult as at present for any individual firm to secure adequate representation all over the world, and being outside the national organisation it will not enjoy the advantages derived from co-operative effort. Groups of manufacturers, none of whom is in direct competition with his associates, may be formed, and, in fact, have been formed on various occasions, with varying degrees of success or failure; such groups, however, are still liable to meet with competition from other similar groups or from independent manufacturers, and also suffer in joint tendering from the fact that one or other of the component firms may be too busily engaged in other directions to be able or willing to quote a close price, with the result that orders that might have benefited the whole group are placed elsewhere. On the other hand, groups of manufacturers in the same line of business may be formed, and here a full measure of co-operation can be realised, together with the widest representation, comparative freedom from home competition, and facilities for co-ordinated specialisation. The best example of such a combination is the Cable-Makers' Association, which since its formation, some 20 years ago, has been remarkably successful, and has benefited both its own members and its customers, besides raising the standard of quality of British cables to a pitch of unrivalled excellence. We believe that this Association has from time to time contemplated the establishment of a co-operative selling organisation to deal with oversea trade, but unfortunately individual manufacturers have been unwilling to pool the trading connections which they have built up for themselves in certain territories, for the benefit of the Association as a whole, although they fully appreciate the advantages that would accrue to all the members from this course. It may be suggested that if an existing Association of such a type has failed to agree upon a co-operative scheme, there is little prospect of agreement between all the engineering trades; but we may again point out that entirely new conditions will prevail in the future. All parties have realised the imperative necessity of collective action and community of interests, and should be willing to subordinate their predilections to the common good, in which they will share.

At the moment the proposal of Mr. Andrews to form a single central body charged with the duty of co-ordinating the activities of the manufacturers and developing a comprehensive organisation for the disposal of their products throughout the world holds the field; apart from the absolute rejection of State control, the details of the scheme are of no immediate concern—they remain to be considered by the proposed committee. But one factor of the first importance demands attention—the method of financing the projected organisation. The author proposed that the assistance of the State should be invoked, in order to cover operating expenses, but mainly to provide for the maintenance of adequate stocks in every overseas centre, without which it is impossible to carry on any considerable trade in standard engineering supplies. But direct assistance from the State is liable to result in a measure of State control, which would not be acceptable to the industry.

In private discussion on the matter, a well-known electrical engineer has suggested an alternative method of finance which is worthy of careful consideration. His proposal is that a very large number of leading British manufacturers of all types of engineering products shall guarantee the interest, and repayment by sinking fund, of any capital subscribed for this purpose. The actual funds might be raised by public subscription for State bonds, but as the manufacturers would be solely responsible for the fund, there would be no question of interference by the State, which would be in the position of a bank lending money to a trading concern. The very large number of guarantors would ensure absolute security, while naturally business would only be placed with manufacturers who were guarantors to the co-operative scheme. We understand that the author regards this suggestion as in every respect better than his own proposal for financing the scheme, and as being free from the many apparent objections to other suggested schemes. But having in view the unimpeachable security, would it not be possible to go direct to the public for the money?

Here we must leave the matter for the moment; but we may be excused for expressing our extreme gratification at the cordial reception accorded to the proposal for the adoption of co-operative methods in connection with our export engineering trade. For many years past, and especially since the outbreak of war, we have constantly pressed upon our readers the urgent necessity of co-operation in order to cope with foreign competition on the one hand, and to reduce the excessive competition between our own people on the other. We will not labour the point—suffice it for us to draw attention to the appended extracts selected from the many articles on this subject that we have published as justification for our pleasure at seeing the policy which we have championed at last, apparently, endorsed by the industry, and in a fair way to be carried into effect.

OUR POLICY ON OVERSEAS TRADE.

We are not in the habit of reproducing extracts from our past volumes, but we make a departure from our custom this week. The important paper and discussion at the Institution of Electrical Engineers last week seem to justify the reprinting of a few of our war-time comments on the subject of co-operation for overseas trade. We believe that the Review's policy is known to most electrical business men, but possibly some who have been too busy to read will care to peruse the following remarks, which are typical of many published both before the outbreak of war and consistently during its progress down to date:—

Co-operation in Trade Expansion.—In the absence of any definite information regarding associated efforts that may be on foot for beginning or extending electrical trading operations . . . . we place ourselves at the service of British electrical manufacturers. Somebody must take the initiative in matters of this kind . . . we can proceed to deliberate seriously, perhaps prepare a plan of campaign, and gather together the necessary forces ready for definite operations to begin at the psychological moment. . . . In co-operation many things are possible that individuals cannot do alone. . . . A dozen or so manufacturers of different classes of machinery or goods might collectively, by one or two efficient representatives sent to each market, study the whole of these markets simultaneously . . . or, they might send a stronger representation to study each in turn. . . . We talk of "capturing trade—let us not be less ready in our trade callings, than our legislators in theirs, to follow up our talking with action. We urge our readers to prepare themselves for carrying the electrical trade war into the countries we have named by beginning to organise their forces straight away. . . . We shall be pleased to do whatever we can to bring together those who desire to consider the taking of joint action, and if our preliminary measures succeed, to leave the matter for those directly concerned to develop fully along their own lines."—Elec. Rev., September 25th, 1914, p. 419.

Co-operation in Trade Expansion.—The willingness on the part of several firms to consider the matter in conference should induce others to take advantage of that frame of mind while it exists. In our view it is not too early for business like deliberations to take place, so that suitable preparations may be made in good time. Indeed, information has reached our ears of magnificent engineering contracts that have lately been booked in a market which our firms have long desired to enter, the contracts referred to having been secured because of a policy of concerted action arranged some time ago by a number of firms. This success alone, coming during war time, suggests that there need be no delay in taking definite measures.—Elec. Rev., October 2nd, 1914, p. 451.

Reconnoitring.—We are not suggesting that British electrical manufacturers are asleep or that they have done nothing. Our post-bag and our conversation with men have told us differently. Here and there individual firms are considering their own personal relation to the position: how they can in their works make this or that new line, or what prospects their particular make of article would have in a new market, and how to get it known there. But there is a danger of their losing heart, *because of the inevitable weakness of individual policy and isolated action.* They could so much more readily and more hopefully consider the difficulties and the prospects, and the financial and technical problems involved if they could only put their heads together. There is a desire on the part of some to act in co-operation, or, at any rate, to study matters in a preliminary way in conference, and we trust as the weeks pass by this disposition may grow, and something useful may be done. We should like to recommend that a public meeting of the electrical industry be summoned at which the position shall be laid before us all by an authority, and discussed seriously and in detail, and without feelings of undue reserve and suspicion.—Elec. Rev., October 16th, 1914, p. 514.

Co-operation.—It may be that other co-operative electrical schemes have lapsed because it is but human that many members of the body corporate should have widely divergent interests, and that co-operation can only be harmoniously conducted when it limits itself to those matters where it can conduce to the good of the whole, and is ruthlessly harsh or unfair to none. . . . As a business people we ought to be co-operating in connection with the supersession of German export trade. . . . There is a general trade co-operation proposition, such as we have recently advocated, which is not too ambitious, and which ought to be carried into effect just as soon as ever possible. We have urged electrical and allied manufacturing firms who are unable alone to tackle the new markets and the new lines of manufactures to put their heads together for these express purposes, and there is a disposition on the part of a number of them to do so. We would that they were more numerous and more enthusiastic. . . . If the Board of Trade cannot undertake specialised investigations of this character, then perhaps our own electrical organisation can do it by a co-operative effort of the manufacturers. . . . It is perfectly true that individual firms have divergent interests, but is it impracticable for them to make some grand united effort at this exceptional time, in order that advantage may be taken of the prevailing opportunity? Certainly that blessed word Co-operation, with which we have opened this article, seems to call for reiteration at the end of it, for it can only be by co-operative effort on very broad lines that we can secure what awaits us.—Elec. Rev., November 20th, 1914, p. 677.

Our Future.—As we have referred to the necessity for the guidance that comes from big men and from experienced experts, we may be permitted to bring these notes to a conclusion by divulging a conversation that we had with a most estimable German gentleman of wide experience several years ago. Mr. J. Stöttner, who, we believe, built up the great business of the Electrical Co., Ltd., in these islands from the very smallest beginnings, and was responsible for the placing of millions of pounds' worth of contracts with the Allgemeine Electricitäts Gesellschaft, in Berlin, was discussing with us shortly before his death the position of the electrical industry in this country. . . . Mr. Stöttner was no longer the representative of the concern to which for years he had devoted himself heart and soul. He appeared to speak with all sincerity, and what he said carried conviction. He deprecated our scattered and entangled manufacturing operations; decried the habit of attempting to manufacture "everything electrical" in a comparatively small factory; advocated the closing or else the complete reorganisation of many of our small factories, which he considered could not hope to manufacture competitively when they devoted themselves to scores and hundreds of more or less dissimilar productions; he would, by a process of arrangement between different firms or companies, concentrate the manufacture of particular lines of machinery or apparatus in specialised factories run on a large scale, in several selected districts—motors here, switchgear there, engines and turbines somewhere else, and so on. This, in brief, was the course advocated by Mr. Stöttner, who knew the reasons for German success in Germany, and for his own success as a competitor here. He positively affirmed that if Britain, as an electrical manufacturing country, was ever to stand up effectively against Germany there was no other way in which it was to be brough about. . . . Since that date we have witnessed the carrying out of the idea on a small scale in connection with some sections of the industry in England, and it has been our privilege to visit works whose owners have had reason for feeling gratified with the measure of success which had attended their efforts at more or less strict specialisation. At times the best concerted schemes "gang aft a-gley," and the many interests requiring reconciliation, and needing to be called upon to make sacrifices and effect compromises, make Mr. Stöttner's proposition one of great complexity and difficulty, but we do not consider that any time spent considering such questions can be wasted in view of the vast changes that lie ahead internationally.—Elec. Rev., July 9th, 1915, p. 37.

The Balfour Report on Trade Organisation and Foreign Competition.—We are unable this week to refer fully to the four reports of Lord Balfour's Committee on Commercial and Industrial Policy After the War, but in view of the discussion at the Institution of Electrical Engineers last week, we may state that consideration of the subject of industrial and commercial organisation brings from the Committee strong recommendations in favour of closer combination among traders as a means of meeting increasing foreign competition. While there is a danger that such combination may not only tend to diminish the individual enterprise to which the progress of British manufacture and industry has been largely due, but may also be carried to a point at which it becomes detrimental to the general interest of the country, they agreed that in some important directions the individualistic methods hitherto adopted should be supplemented or entirely replaced by co-operation in respect of (1) the securing of supplies of materials, (2) production, including standardisation and scientific and industrial research, and (3) marketing. It is very desirable they think that in all important British industries there should exist strong, comprehensive, and well-organised associations which should be clearing-houses of information of common interest, competent to voice the opinion and needs of their respective trades as a whole. Every encouragement should be given by the Government to the formation of combinations of manufacturers and others concerned with securing supplies and materials. In regard to production, the Committee think that the constructive action must come from the industries themselves. While the Committee do not think it would be expedient for the Government to aim at positive control of trade combinations, they think that some means should be devised for securing to a responsible Government Department adequate information as to their formation, with provision for State investigation in special cases. They also think that combinations should be legalised so as to be enforceable between members, provided that they are registered at the Board of Trade, which should have power to call for information as to their operations. In the case of international combinations to which British firms are parties compulsory registration is recommended

LARGE STEAM TURBINES.

[COMMUNICATED.]

There is little doubt that sooner or later turbines that are considerably larger and more economical than those at present in use will be installed in power stations in this country. The advantages of large generating sets in stations erected on roomy and efficient sites are pretty generally recognised. Turbo-generators having capacities in the neighbourhood of 20,000 KW. are economical in steam consumption; the first cost per KW. is low, and, compared with other prime movers and turbines of smaller outputs, the floor space required for each KW. installed is a remarkably small quantity. A 20,000-KW. set does not, of course take up anything like 10 times as much space as a 2,000-KW. set, and when we compare the space occupied by 20,000-KW. and by 200-KW. machines, the discrepancy becomes much more marked. Similarly, in respect of labour it is evident, having regard to the fact that a turbine is self-lubricating, that a 20,000-KW. set will not require very much more attention than a set that is considerably smaller. These advantages, coupled with the fact that the large units have a lower steam consumption than those of smaller capacities, render their use desirable in connection with the economical generation of electricity. In the report recently issued by the Coal Conservation Sub-Committee it is proposed to install in the national power houses sets having outputs of not less than 20,000 KW., and it is considered that in the most important industrial districts machines of 50,000 KW. might be used.

Generating sets of such capacities have not, as yet, been put into operation in Great Britain, although a 25,000-KW. machine was built some time back by Messrs. C. A. Parsons for the Fisk Street station of the Commonwealth Edison Co., U.S.A., the order, it is said, having come to this country mainly by reason of the superior steam economy guaranteed. The consumption guaranteed was exceptionally low. With steam at an initial pressure of 200 lb. per sq. in., superheated to 200° F. and with an absolute pressure in the condenser equivalent to 1 in., the turbine was to have, when working at 20,000 KW., a consumption of not more than 11·25 lb. per unit. At 25 per cent. over or under load the consumption per unit was not to exceed 11·65 lb., and at half load 12·5 lb. The penalty for any excess above 12·25 lb. at 20,000 KW. was £500 for each one-fifth of a pound, but improvements were to be rewarded by a bonus of equal rate. The guaranteed steam consumption is equal to 8·1 lb. per shaft horse-power, a result that has not hitherto been attained in marine practice. Turbine steam consumptions have steadily been reduced, owing partly to the increase in size and partly to modifications in design as the result of experience. Between the years 1906 and 1911 there was marked progress in this direction. During this period the steam consumption per KW.-hour was reduced from 12·75 lb. to 11·6 lb., and the total efficiency—*i.e.*, the actual output of generator divided by the mechanical equivalent of heat drop according to adiabatic expansion—was raised from 63·8 per cent. in 1906 to 66·3 per cent. in 1907 and to 68·4 in 1910, these figures relating to turbines of moderate outputs.

The 20,000- and 30,000-KW. turbines that have so far been built are constructed on rather different lines to smaller turbines, such as those at present in operation in this country. They consist of high- and low-pressure units, and, in the case of the Parsons machine built for the Commonwealth Electric Co., these two units are arranged in tandem and are mechanically coupled. The low-pressure turbine is of the double-flow type, the steam from the high-pressure element entering at the centre and passing to the right and left through successive stages of expansion, exhausting at both ends and then flowing to the condenser, which has a cooling surface of 39,000 sq. ft. Apart from the fact, however, that the steam is utilised in two separate cylinders, high and low pressure, each developing the same horse-power, and that the low-pressure element is of the double-flow type, this machine is built on more or less standard lines. The high-pressure turbine is of the single-flow parallel type, the end pressure being balanced by three dummy pistons of standard design. In accordance with the practice which has now been adopted by Messrs. C. A. Parsons for some years, and with very beneficial results, the tips of the blades are thinned, so that in the event of the rotor touching the interior of the casing, which it is apt to do in the event of the casing being distorted, the blades do not suffer material damage. Before this practice of thinning the blades was adopted, blade stripping in reaction turbines, which must, of course, have fine radial clearances, was not altogether an uncommon occurrence, but by thinning the blade tips this trouble has been greatly reduced. The blades in that portion of the turbine that is subjected to the high temperature of the superheated steam are of copper.

In American power houses, where turbines of large capacity have been installed, the saving in floor space has been very considerable, and especially where these sets have replaced reciprocating engines. A case in point is furnished by the Seventy-Fourth Street station of the Interborough Rapid Transit Co., in which in the year 1915 four reciprocating engines, having an aggregate capacity of 28,000 KW., were replaced by three 30,000-KW. turbine sets giving an aggregate capacity of 90,000 KW. with the same floor space. These turbines, which are Westinghouse machines, work at a steam pressure of 200 lb. per sq. in., a vacuum of 29 in., and a superheat of 120° F. The most economical load is 25,000 KW., at which the steam consumption is said to be 11·27 lb. per unit. The reciprocating sets worked at a pressure of 150 lb. per sq. in. and a vacuum of 25 in., and consumed 17·3 lb. of steam per KW.-hour. Hence the steam consumption of the turbine is only approximately 65 per cent. of that of the reciprocating engines, each consumption being taken at the point of best efficiency. If the three turbines were operated three-fourths of the time at 25,000 KW. (the output at which the machines are most efficient) the saving in fuel alone for each unit would amount to over £40,000 per annum, based on coal at 15s. per ton, and an average evaporation of 8·7 lb. of water per lb. of coal. These turbines also have two cylinders, high- and low-pressure, but, unlike the Parsons machine supplied to the Commonwealth Edison Co., each element drives a separate alternator operating at the most desirable speed for the corresponding turbine cylinder. Clearly the cost of a unit built upon these lines is greater than that of one with only one alternator, or a turbine in which the steam expands in a single cylinder, but with machines of this size the two-cylinder arrangement is necessary to obtain the best economy. Although all these large reaction turbines have two separate cylinders, the same governor and oil pump will serve for both parts of the machine. The governor dealing with the steam at boiler pressure controls the speed of both elements, and gives variable back pressure at the high-pressure end and the best efficiency at all intermediate loads, as well as the load for which the machine is mainly intended.

At first it may appear that this practice of using two alternators, one for each cylinder, necessitates coupling each machine to the station bus-bars separately; but this is not the case. The two alternators are permanently connected together with cables, and are synchronised as a single set, and when the machine is switched on to the bus-bars the low-pressure element carries all the load it is able to carry with the steam it receives from the high-pressure element. When starting the set the fields of both generators are energised, and when steam is admitted to the machine and the rotors begin to revolve, they build up their voltages and pull into step. At the maximum output the two elements share the load equally, but at intermediate loads the high-pressure portion carries slightly heavier loads than the low-pressure portion. At a load of 30,000 KW. the steam pressure at the low-pressure inlet is 18 lb. absolute, at 25,000 KW. 14 lb., and at 16,000 KW. 10 lb. The double-flow arrangement, though abandoned on turbines of such capacities as those operating at the present time in this country, offers marked advantages on the low-pressure portion of machines such as those under consideration. It eliminates all end pressure, and gives ample blade area for the large volumes of steam that have to be dealt with.

Naturally, turbo-generators of this size require a very large volume of air to cool them, and the idea of utilising the discharged air at increased temperature for the boiler draught seems to demand special consideration with such large sets. The scheme has been adopted in the Seventy-Fourth Street station of the Interborough Rapid Transit Co., and it can, of course, be adopted in other large stations with equal advantage. Although it appears at first sight that the plan of dividing these large generating sets into two units, high- and low-pressure, is an expensive procedure which ought to be avoided, experience shows that the policy is a sound one, for the turbine designer may adopt proportions conducive to economy without being restricted by mechanical limitations. That an economical 25,000-KW., 25-cycle set can be built with only one alternator is evident from the fact that the Parsons machine built for the Commonwealth Edison Co. is constructed on these lines. The speed in this case is 750 R.P.M., but in the case of the Westinghouse sets erected in the Seventy-Fourth Street station of the Interborough Rapid Transit Co., which are also 25-cycle machines, the speed of the high-pressure rotor is 1,500 R.P.M., whilst the low-pressure rotor runs at half this speed, and the numbers of poles on the two alternators differ accordingly. Naturally, the high-pressure element is considerably smaller than the low-pressure one, and the double-alternator arrangement enables half the set to be run separately in case of emergency.

JOINTS ON TRIPLE-CONCENTRIC TO THREE-CORE LEAD-COVERED CABLES.

By P. WARDLE, Carlisle Electricity Works.

The writer, in submitting the following article for publication, hopes that it will be of interest to those mains engineers who are responsible for the maintenance and repair of D.C. three-wire distributing networks, where the original distributors laid down consist of triple-concentric, lead-covered and armoured cables laid direct, but which, during the last few years, have been, and are being, discarded in favour of three-core, paper-insulated, lead-covered and armoured cables, laid direct.

However, it so happens, as in the writer's experience, that in some towns there may be several miles of this class of distributor, of which, for many reasons, the renewals cannot be carried out all at once, but, on the other hand, may have to extend over a period of years. Again, some of these distributors have been laid anything from 15 to 20 years, and although the condition of the cable may be good considering the circumstances, faults invariably develop at the glands of both service and straight-through joint-boxes, and so damage the cable that a new piece has to be spliced in.

It may also be found necessary to extend an existing T.C. distributor when only three-core cable is available, and the usual practice is to use a straight-through c.i. joint-box.

As is well known, the standard practice now adopted in jointing three-core cables is to enclose the joint in a plumbed lead sleeve, and it is the writer's endeavour to apply this to T.C. cables wherever possible.

The chief difficulty previously experienced in making a T.C. to three-core sleeve joint has been that the necessary fittings have been too bulky, and would not allow a reasonable-sized sleeve to fit over them. This has now been overcome by the writer, and, on referring to fig. 1, there will be seen a T.C. to three-core joint, on a T.C. ·12, ·06, ·12 to three-core ·12, ·075, ·12 distributor, with the finished joint shown on the right of the figure.

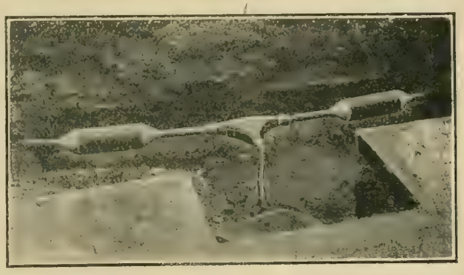


Fig. 2.—Three-core Service Joint Inserted in Triple-concentric Cable.

The distance across the outside edges of the fittings, which are fixed diametrically opposite, is 3 in., and the lead sleeve has an internal diameter of 4 in.

Fig. 2 shows two similar joints on the same size of distributor with a three-core service joint in plumbed sleeve in the centre. Originally the service joint was enclosed in a cast-iron box with porcelain bushes, but owing to a short-circuit fault in the gland of the box, rendering the T.C. distributor at that point unfit for further use, it was necessary to splice in a new piece of three-core cable.

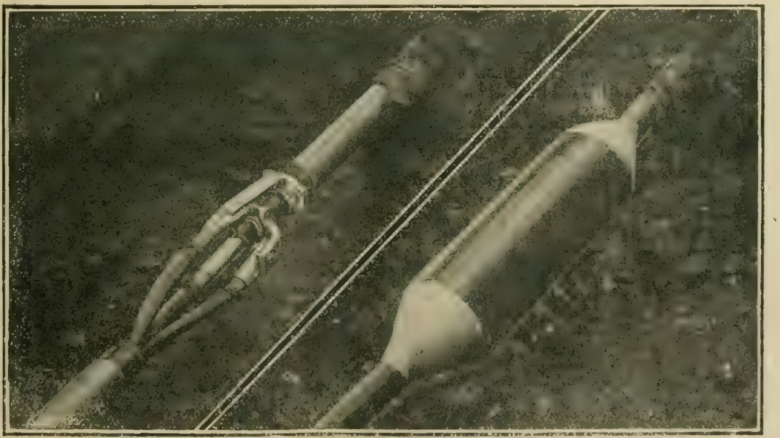


Fig. 1.—Triple-concentric to Three-core Cable Joint.

The writer at the present moment is not aware of this method of jointing ever having been previously adopted; but if there are any readers who have put the idea into practical use, the writer would be glad if they would kindly give their views with regard to this class of joint.

Telephones in France.—The Société des Telephones Mildé is the name of a new company which has lately been formed in Paris, with a capital of £180,000, to manufacture telephonic apparatus.

OVERSEAS TRADE AFTER THE WAR.

By ANDREW STEWART, M.I.E.E.

The fact that any scientific or learned society should spend an evening discussing the development of overseas commerce is another reminder that the war has shaken our most cherished institutions to their foundations, and, whether we like it or not, changes are taking place in our outlook and practice which would have been considered impossible a few years ago.

Papers on commercial policy have always been considered outside the scope of a learned or scientific body, not so much because the subject is unscientific or because the exponents of commercial policy may be less learned than those who could deal with the properties of materials and the laws governing their use, but probably because, not being an exact science, and being bound up with problems of a more mercenary and controversial nature, they were likely to give rise to differences of opinion which might disturb the harmony of the well-ordered scientific mind.

Such papers, however, have their dangers. Mr. Andrews's interesting contribution did not go far to disturb the scientific mind, but we can imagine a paper on the commercial aspect of the Coal Conservation Sub-Committee's Report. The advocates of municipal or State control, led, say, by Mr. Pearce, and the advocates of private enterprise no less ably generalled by a veteran like Mr. Madgen—well, there would be dirty work in Westminster that night!

It is to be hoped, however, that the Council of the Institution, guided by our able and tactful President, will do what they can to prevent the Institution of Electrical Engineers from sliding down the slippery slope of controversial commercialism.

To return to Mr. Andrews's paper on "The Overseas Distribution of Engineering Appliances," it appears to the writer, who has had a good deal of experience in selling electrical apparatus abroad, particularly in Europe, that the problem of developing external trade is more a question of simplifying, not complicating, the distribution of the goods.

A great and complex organisation which intervenes between the manufacturer and the user seems to be an unnecessary link, reducing the efficiency and adding to the cost in much the same way as an unnecessary number of transformers and converters in a transmission system.

I have used the analogy because it appeals to the engineering mind, and I want to disown it at once, and to direct the reader's attention to the theory that sales organisation is not an exact science at all.

What is more natural to an engineer than to apply engineering analogies to trade problems; to liken manufacturers to generators, a control board to a switchboard, and a distributing and selling organisation to the distribution system with its rows of consumers, is all very nice and impracticable, for the analogy is bad!

Business, like medicine, is not an exact science. When a doctor gives a patient a dose of any particular drug, he is not sure what the result will be. The result of a drug can never be predicted with accuracy, so many variables, such as the constitution and idiosyncracies of the patient, have to be taken into account. Thus certain things have uncertain results. In business various customers are impressed in different ways. A feature in design that has no interest for one purchaser, will charm the dollars out of the pocket of another.

In engineering, on the other hand, any variation in the chemical or physical properties of a material has definite and calculable results. That is why the engineer is not often a good business man; he applies exact standards to things that are inherently inexact.

Business is not science at all—it is common sense; and when we try to treat it as an exact science we run full tilt up against reality and attempt the impossible. The successful business man is usually possessed of a searching and comprehensive mind; the engineer, on the other hand, has a mind that is intensive and inventive, with some special bent—two very different types. These two qualities are seldom found together.

Most business failures are due to want of common sense, for, like most seemingly simple things, the application of common sense to business problems is uncommonly difficult. We must, therefore, be prepared to treat business problems as something inherently different from engineering problems.

A controlling organisation composed of representatives from Chambers of Commerce, Ministry of Reconstruction, Board of Trade, Foreign Office, Engineering Standards Committee, Federation of British Industries, Shipping Merchants (what has the B.E.A.M.A. done to be left out of this list?) would become a formidable and inflexible bureaucratic institution, like unto a Government Department, possessing neither soul to be damned nor body to be kicked, but an unending source of bulletins, instructions, and regulations, which would probably prove of greater benefit to the paper-making, printing, and waste paper industries, than to the engineering industry which it was supposed to represent.

Such an organisation, if it were composed on anything like the lines indicated by Mr. Andrews in his paper, would no doubt be housed in some building worthy of the Board's size and status. It would probably be staffed by an army of pig-tailed flappers, dressed in transparent stockings and fur coats, the usual uniform of the Government officialette.

The click of the typewriter, the clatter of tea cups, and other sounds usually associated with feminine industry, might be heard from early morn till dewy eve, but what shall it profit the British manufacturer if he get all these things, and yet lose the business because his prices are too high? Price, not distribution, is the crux of overseas trade.

Would an organisation such as this be superior to the established order of things? Would it give greater satisfaction to the overseas purchaser? Is there any organisation or institution of the kind in existence that gives the satisfaction, celerity, and personal interest that the average purchaser expects from the firm that supplies the machinery he wants?

We have first, last, and all the time to please the user, and by this test any controlling or selling organisation will be judged.

Our export trade is obtained and held because the user knows he is dealing with a reliable and reputable British firm, who generally lose no time in putting right any trouble that may arise. Would the user fare better were he annoyed and irritated by the circumlocutory methods of a bureaucracy?

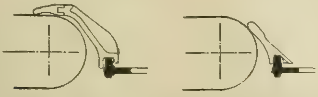
The success of the Allgemeine Elektrizitäts Gesellschaft, Bergmann, Siemens, and other German undertakings was due to the fact that the user could get their products from branch offices in most parts of the world, and repairs and renewals were effected quickly and cheaply from parts obtainable from their branch houses anywhere; there was no difficulty or delay in dealing directly with headquarters, and headquarters invariably displayed a personal interest, often only artificial, but no less satisfactory to the customer, when there was a difficulty or grievance. How can we hope to succeed if we interpose a cold-blooded and lethargic official or officialette between the manufacturer and his client?

Individualism has made us a great nation. It is suited to our temperament and inclinations; we must see to it that in the evolution of new business methods we do not become willing victims of the dire despotism of a disinterested and domineering bureaucracy.

U.S. Engineering Council.—At the first annual meeting of the Engineering Council, on February 21st, Mr. J. Parke Channing was elected chairman, Messrs. H. W. Buck and G. F. Swain vice-chairmen, and Mr. A. D. Flinn secretary. The Council is now composed of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, having a membership of 33,000, and known as "founder societies." The new chairman is vice-president of the Miami Copper Co. and the General Development Co..—*Electrical World.*

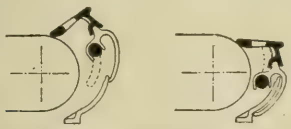
PREVENTABLE WASTE OF COAL.

In a letter to the *Electrical World* of March 16th, Mr. G. W. Partridge, engineer and manager, London Electric Supply Corporation, Ltd., refers to a paper by Mr. D. M. Myers on the above subject, and makes the following remarks on two devices which he has at work at the Deptford power station, London, and which have proved to contain great possibilities in the way of coal saving.



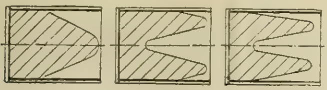
Figs. 1 and 2.—Fixed Clinker Dams.

Many classes of coal tend to "spread" on the grate in open formation, with isolated patches and intervening bare spaces, making necessary some form of clinker dam or dumping bar at the rear end, in order to hold the coal back and maintain a compact fuel-bed until combustion is completed. The dam in general use has hitherto been of the fixed type, two forms of which are illustrated in figs. 1 and 2. Mr. Partridge has found, however, that these fixed bars have very considerable limitations, as if they are made sufficiently high to bank up and retain efficiently the "spreading" classes of coal, the ash and clinker will not pass over, but effect a lodgment on, and choke up, the grate. On the other hand, if they are made sufficiently low to clear the ash refuse, the grate fails to retain the "spreading" coal, with the result that a large amount of excess air is admitted, due to the open formation of the fuel-bed.



Figs. 3 and 4.—Adjustable Dumping-Bar Set for Spreading Coal and Close-Lying Coal.

To overcome this difficulty, the first device which has been adopted consists of an adjustable dumping-bar, one design of which is illustrated diagrammatically in figs. 3 and 4. The dumping-bars, of sectional type, pivot on supporting plates which make an air seal with a fixed "former" plate, this plate constituting the front side of the ash-pit. The bearer bar carrying the sealing-plate and dumping-bar can be raised or lowered by hand, or, preferably, by means of a small hydraulic cylinder connected to the feed-water mains, the operating cocks being placed adjacent to the sight-door at the rear end of the furnace. These dumping-bars can, therefore, be set at the most suitable height for the particular fuel that is being burned, and, should the accumulation of clinker require it, can be readily operated by merely lowering the bars for a few minutes until the *débris* has passed over, when they can be reset at the original or any suitable height. The main features of this apparatus are :—Flexibility of parts ; wide angular rotation of the ash-receiving face ; quick and ready renewal of parts ; rocking or pushing back avoided ; complete air seal in all positions ; ease of operation.



Figs. 5, 6 and 7.—Uneven Distribution of Coal Sometimes Obtained on Grates.

The second device referred to above applies to the furnace door. One essential condition for good furnace efficiency is that the whole area of the grate up to the dumping bars should be equally covered by the fuel. Frequently the fire fringe assumes forms such as are indicated in figs. 5 to 7. These irregularities may be due to various causes, such as size and constitution of the coal, design of the chute feeding the coal hopper, or some feature in the design of the arch or furnace setting. It is also found that distortion and collapse of the type of guillotine door generally in use is not infrequent, more especially when burning fierce or highly-volatile coals on a furnace setting which has been designed to give good front-end ignition with low volatile or low-grade fuels. He has found these difficulties almost entirely overcome by the use of the sectional adjustable door illustrated in fig. 8, which it will be seen consists of a series of narrow doors suitably lined with fire-brick and fitted with renewable shoes, each one separately and pivotally hung from a common bearer girder and individually adjustable, and so arranged that they may be collectively raised or lowered as required. Advantages of this design are, briefly :—

Control of the fuel thickness, and, therefore, of the distribution of the fire over the grate area ; durability of parts ; quick and ready renewal of burnt parts ; freedom of working ; effective air sealing.

The advantage of having the adjustment and flexibility of these two devices will be obvious to all users of chain or other travelling-grate stokers under any conditions of working with high or low-grade fuels, and they should be found particulary effective in improving the efficiency of boiler plant with the poor-quality coals at present being handled.

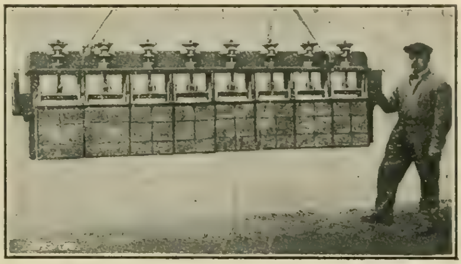


Fig. 8.—Sectional Adjustable Gate for Insuring Uniform Fuel Bed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Reinforced Non-Ferrous Metals (Denny's Process).

A somewhat original method of reinforcing metals, in a similar way to that of making reinforced concrete, has been devised and patented by Mr. C. W. Denny, of 22, Edwardes Square, Kensington, London. The process, which lends itself to the manufacture of tubes and plates, would appear to have a very large field of application in various arts and manufactures. The reinforcing metal is preferably perforated steel of suitable thickness for the work and two notable applications are to copper and lead. In making reinforced copper the perforated metal is prepared by any well-known method for electro-deposition, and finally copper-plated to any required thickness, the deposition of copper going right through the holes, and finally forming a sheet of copper with the steel core inside. The process of deposition entirely locks the copper to the steel, and a plate so formed will stand bending and pressing without the copper leaving the iron in any way, the copper being perfectly adhesive to the whole surface and mechanically locked to the steel. The accompanying illustration, fig. 1, shows a plate in various stages of the process.

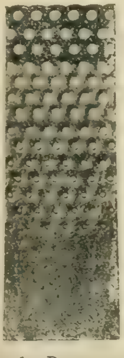


Fig. 1.—Reinforced Copper Plate in Course of Formation.

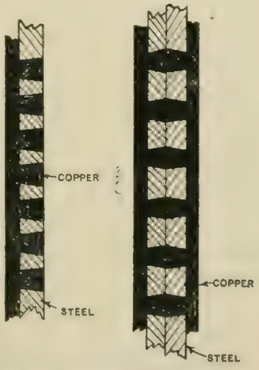


Fig. 2.—Sections of Reinforced Copper Sheets.

In some cases the copper can be rolled on hot. The saving in the use of reinforced copper is in the neighbourhood of 50 per cent., and its application to electrical purposes would, no doubt, show a great economy.

The reinforcing of lead with steel can be carried out in a similar manner to that described above; but as lead is a much softer metal than copper, it has been found quite practicable to reinforce lead in the form of sheets by simply rolling or pressing the lead into the perforations.

The manufacture of lead-lined tubes is somewhat more difficult, involving the use of drawing methods. We understand that Mr. Denny has a process for the manufacture of tubes, tees, and bends with reinforced lead, which will be a big advance on the present methods of producing such articles. The lead lining of tanks, cylinders, and the like can now be commercially carried out from reinforced lead sheets, it only being necessary to burn the joints. Such products would, no doubt, have a wide application in chemical and dye works equipment, and in all cases where acid fumes or acidulated liquids have to be stored, conveyed, or brought in contact with steel or ironwork. The illustrations in fig. 2 show sections of reinforced copper, showing the mechanical lock which is so important in combining two metals together.

Reinforced copper as applied to electrical work has a magnetic effect, owing to the steel core becoming magnetised by the passage of current through it, and might be of advantage, Mr. Denny suggests, in constructing switch blades, controller fingers, &c.

Owing to the restricted use and general shortage of non-ferrous metals, reinforced non-ferrous metals might with advantage be used for many purposes.

Aeroplane Lighting Set.

Messrs. Joseph Lucas, Ltd., Birmingham, who have for some years specialised on the production of electric lighting sets for use on motor cars, are now devoting attention to such installations for aeroplane lighting purposes. Among their interesting productions in this direction is a 12-volt 250-watt dynamo, which runs at a speed of 3,500 r.p.m., and is combined with the propeller of the machine.

E.M.C. Fans.—Referring to the note on these fans in our last issue, we unintentionally misstated the maker's claim, which was that the fans fitted with regulation blades were more efficient than those fitted with box blades.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

While fighting German autocracy, the democratic nations of the world are voluntarily submitting to all kinds of Government control and regulation. Canada, though perhaps somewhat belated in regard to such matters, usually having a considerable time lag, is no exception to the general rule, for, besides meatless days which have now been in force for quite a long time, there have been heatless days. Even eatless days have been jocularly referred to!

The 9th, 10th and 11th of February were, in Eastern Canada, observed practically as holidays, owing to the order of the Fuel Controller that all except certain favoured classes of industries, shops and offices should be closed to reduce the consumption of fuel to the lowest possible limit. Fortunately for the country those particular days turned out to be quite warm, as there was a general thaw—a great relief from the prevailing weather of the previous weeks, when even in Toronto, the temperature reached 25° and 30° F. below zero, this having been the most severe winter experienced for many years.

Because of the really acute shortage of coal which has been general all over the Continent of North America, the intense cold was a particularly awkward circumstance. There were signs of a shortage early, owing to congestion on the railways and to the great demands for coal made by the engineering and other industries on account of the war, but the heavy snowfalls, the low temperatures and the gales have added enormously to the difficulties of transportation and have created hardships among the people, especially the poorer classes, from want of fuel.

Owing to great water-power development, especially in Ontario and Quebec, electrical energy has become so cheap for power and lighting purposes, that people have begun to think that its use for heating is going to solve the fuel problem; this being the case it has been necessary for technical men to demonstrate the absurdity of the idea.

Ontario has no coal and is therefore dependent upon the United States for practically her entire supply of fuel at least for the cities—in the country districts wood is largely used. The acute fuel situation, both here and in the United States, has turned everyone's thoughts towards it, and Canadians are beginning to ask themselves what they will do for fuel in the event of the United States restricting the exportation of coal to the Dominion. This, if it does not occur soon, will inevitably come sooner or later on account of the gradual exhaustion of the supply over the border.

As usual, electricity was hailed in many quarters as the saving clause, since Canada is so well off for water-power, but quite a simple calculation will show beyond question that all Canada's share of the power of Niagara Falls would not heat the homes of Toronto alone, to say nothing of the power requirements, lighting, tramways, and the heating of offices, factories, &c., and that all the available water-power of Canada would not warm the homes of Ontario alone. Electrical energy has a distinct and very useful place for special purposes, such as cooking, &c., in the Canadian climate, as an auxiliary to other methods of heating, to furnish heat in the cool days of late spring and early autumn, but decidedly not as a general heating agent on a large scale throughout the winter, and this is not merely because of excessive cost (electricity at ½d. per kw.-hour is about four times as expensive for heating a house as anthracite at £2 per ton—2,000 lb.), but on account of the enormous quantity of power that would be required, as indicated above. On the other hand, electricity can be very profitable, from the point of view of conserving fuel supplies employed for mechanical power purposes. Engineers in the United States have recently been pointing out the enormous saving in fuel that could be effected if all the railways were operated by electric power, even if coal were the source of energy. The President of the American Institute of Electrical Engineers, in an address a few weeks ago, pointed out that for every 6 lb. of coal burnt on locomotives, and from which one h.p.-hour is obtained, three or four times as much work could be obtained from that quantity if it were burnt under the boilers of a large modern electric station and delivered to electric locomotives, thus the saving in coal due to electrification of the railroads would be very large indeed in the aggregate, and if hydro-electric energy were used it would, of course, be much larger. He also pointed out that great saving would result from the fact that at present some 15 per cent. of the coal used by the United States railways is employed solely for the purpose of hauling their own coal supplies—were these supplies no longer required, the whole of the trucks used could be employed for hauling profitable freight with the same track facilities.

The engineers of the Dominion, having warned the public of the seriousness of the coal problem, not only at the moment (as has been brought home forcibly to the said public by other agencies) but for the future, are now preparing to tackle the problem as they should by endeavouring to find the proper remedy.

Several proposals have been made already, of course; for example, the Department of Mines at Ottawa urges the immediate utilisation of peat bogs, of which there are extensive areas here; the Commission of Conservation is advising everyone to burn wood next winter, and recommends that municipal authorities should begin laying in stocks at once.

The Provincial Government in Ontario has already decided to cut timber on Crown lands and burn nothing but wood in all the provincial public buildings next season.

The Department of Mines, while advocating the use of briquetted peat for burning in stoves and furnaces for next winter, takes a much larger view and has pointed out what can be done by gasification, recovery of by-products, and generation of electric power.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Association of British Electrical Engineers.

I have read with interest the information contained in your issue of April 5th, concerning this proposed Association.

Special emphasis is laid on the fact that it is in no sense intended to be a Trade Union.

In this connection it is, perhaps, worth considering the second report of the Whitley Committee, in which it is laid down that the expression "employers and workmen" used in these reports is intended to cover State and municipal authorities and persons employed by them.

The Committee recommend that such authorities and their workpeople should take into consideration the proposals made in these reports, with a view to determining how far they can suitably be adopted.

This unquestionably may be regarded as an indication that the Whitley Councils may, and probably will, be applied to municipal electricity supply departments.

The first Whitley Report states quite definitely that membership of the Councils is confined to representatives of the employers and Trade Unions. Other organisations are either excluded or admitted only by consent of that side of the Council of which they would form a part.

The management or executive section of industry has been excluded (I believe with full intention) from the Whitley Councils, doubtless because its members have hitherto been averse to anything which savours of Trade Unionism, and are entirely unorganised.

Before it is too late, I suggest to the founders of this new organisation that they reconsider their position, and form themselves into a body which may receive some measure of consideration when the vital questions which will be raised at the Whitley Councils come to be discussed. Otherwise, there seems little doubt that between the municipal authorities on the one side and the Electrical Trades Union on the other the members of the B.E.E. will be ground exceeding small.

Doubtful.

Electric Power Supply and After-War Industry.—The Newcastle resolutions printed in our issue of April 5th, were carried unanimously at the annual general meeting of the Association of Chambers of Commerce on 10th inst. Copies of the resolutions were forwarded to the Minister of Munitions in addition to the other Ministers mentioned.

LEGAL.

Calderwood v. Coniston Electrolytic Copper Works, Ltd., and Douvreleur.

In the King's Bench Division, on Monday, Mr. Justice Coleridge had before him an action brought by Mr. John Jackson Calderwood, an engineer, of Seven Kings, Essex, against defendants, of Warwick Court, Gray's Inn, and Raymond Douvreleur, of Vauche Loire, France, claiming £150, four months' arrears of salary at £450 a year as engineer of a company formed to extract copper from mine dumps by the electrolytic process. The defence was that plaintiff's agreement terminated on November 6th, 1916, and that he had been paid his salary up to that date.

Mr. Frank Powell, K.C., for the plaintiff, said although the defendant company was registered in England, everyone connected with it, except the secretary, was French. The other defendant — M. Douvreleur—was the chairman of directors. The company got a lease of property consisting largely of dumps from old copper mines near Lake Coniston, in Lancashire. It was thought there was enough copper in the dumps to make it worth while to apply an electrolytic process for its extraction. The ordinary process would have been too expensive. The electrolytic process did not prove to be successful, the company got through its money, and the shareholders declined to find more. M. Douvreleur said the thing had better be closed down, but plaintiff suggested that someone else might be found to provide the money for another process. Eventually Baron de Catelin came over from France, inspected the property, and expressed his satisfaction, but later intimated he did not intend to take over the property. Plaintiff claimed wages from November 6th till the date in March when Baron de Catelin sent his intimation.

Mr. Lewis Thomas, K.C., in defence, said plaintiff's continuance after November 6th was conditional upon Baron de Catelin purchasing the mines, which he did not do.

His Lordship entered judgment for plaintiff for £150 as against the company and for M. Douvreleur as against plaintiff, the costs to be apportioned by the Taxing Master.

Using Current During Prohibited Hours.

The *Times* reports that on 18th inst., at Woolwich Police Court, W. Maskell was fined £5 under the Lighting, Heating and Power Order, for causing electric current to be consumed at the New Cinema, New Road, Woolwich, during prohibited hours. Sergeant Kilby said he found a kinema entertainment in progress at 11.30 in the morning. Under the Order, power was not allowed to be used for the purpose of entertainment before 1 p.m. The defendant said that he had written to the Board of Trade asking for exemption from this rule, and thought he could continue the morning show pending a decision.

WAR ITEMS.

Copper and Aluminium in Germany.—Discussing the statements made recently by the chairman of the British Aluminium Co., a leading German newspaper observes that it is no secret that Germany has embarked upon the production of aluminium on a large scale during the war, although opinions differ as to whether the German works will be able to meet international competition after the war. It is considered, however, to be certain that the reported increase in the British production of aluminium, proceeding simultaneously with a very large augmentation in the output of copper in the period succeeding the war, will render not improbable some over-production of the latter metal. If the copper needs of Britain and her Allies are estimated at 50,000 tons per month for war purposes, the German newspaper remarks that it is obvious that these requirements will be considerably reduced the moment peace is concluded. This circumstance is regarded as of importance to Germany, as the newspaper states that it awakens the hope that the present exceptionally high prices for copper will fall through this disproportion between supply and demand, and especially that there will be no question that it will be rendered possible for Germany to continue to obtain supplies of the indispensable copper, despite the competition of aluminium and other metals.

After-Meeting Refreshments.—The annual meeting of the Dansk Elektroteknisk Forening was recently held in Copenhagen. According to the *Teknisk Tidskrift*, of that city, the meeting was followed by refreshments, at which whisky and soda, coffee, and Vienna bread were served at a charge of 1 kronor (about 1s. 1½d.) per person.

Trading with the Enemy.—The "London Gazette" for April 19th contains further lists of bodies and persons in the following countries with whom trading is prohibited :—Chile, Colombia, Denmark, Ecuador, Mexico, Netherlands, Netherlands East Indies, Peru, Fernando Po, Spain, and Sweden.

Exports to China.—Names of further persons and bodies in China to whom exports may be consigned appear in the *London Gazette* for April 19th.

Ministry of Munitions Order.—The Minister of Munitions has issued an Order prohibiting the use, purchase, sale, or delivery of any gas works retort carbon, coke oven carbon, or pitch coke, except under permit and to permit holders.

Exemption Applications.—At Morecambe, last week, in the case of H. L. Bentley, foreman fitter, aged 38, single, Class A, and A. Darnborough, electrician, aged 32, single, Class B 1, both employed in the Corporation electricity department, Mr. Annetts, the borough electrical engineer, said he had done all in his power to get substitutes, and had advertised extensively. He got a wounded soldier, but after going to the trouble of training him he went on to munitions. The National Service Representative hoped the Corporation, who were represented by Mr. T. P. Tilly (town clerk), would not appeal again for any Class A man, who were now wanted. Temporary exemption to May 1st was allowed.

At Oxford, on April 15th, there was a review of the case of A. W. Oakley (37), unit adjustor, with the Electric Tramway Co., and two months' exemption was granted.

Bath Tribunal has refused exemption to V. B. Rummings (18, Class A), engaged with the Electric Tramways, Ltd.

West Kent Appeal Court heard a National Service appeal against C. S. Padgham (39, Grade 2), engaged at the Tonbridge U.D.C. electricity works. The exemption was cancelled, with 28 days' grace.

The Malvern Tribunal has, on the application of the Military, withdrawn exemption held by S. Armstrong, electrician, on the ground that he has left the position he held when exemption was granted.

Mansfield Tramway Co. appealed for the retention of W. J. Ashburner (39, C 3), permanent-way foreman, twice rejected. Conditional exemption was conceded.

At Coventry, the National Service Representative appealed against exemption held by a charge-hand (34, C 2), and seven stokers, three in Class A, one in B 1, and three in C 1, engaged at the municipal refuse destructor works. The charge-hand and the six stokers had their exemption confirmed, and the other stoker was ordered to join up in 28 days.

At Oxford, a review was made by the County Appeal Court of the case of W. Townsend (27, general service), shift engineer at the Witney U.D.C. electricity works, given three months' exemption on March 20th. The engineer and manager (Mr. Curel) stated that when engaged Townsend had been totally rejected. The exemption was cancelled.

Bradford-on-Avon Tribunal has granted exemption until May 30th to E. E. Daniel (41, C 2), electrical engineer at Winsley Sanatorium.

At Faringdon, the National Service Representative applied for the withdrawal of conditional exemption held by John Launchbury (30, B 1), engineer with the Electric Light Co., on the ground that it was not in the national interests that he should remain in civil life. As he is the only practical man left who understands the plant, &c., the Tribunal decided that he could not be spared, and the exemption was confirmed.

Tunbridge Wells Tribunal has granted three months' exemption to A. E. Hills, electric light wireman.

At Lancaster, a local firm appealed for the retention of an electrician and fitter (41, C 1), the only one left in their employ, and whom they had failed to substitute. A fresh medical examination was ordered.

At Bedford, exemption until July 15th was granted to R. N. Turner (21), electrical fitter, engaged with the Igranic Co.

BUSINESS NOTES.

Overseas Trade Advisory Committee.—The following gentlemen have been appointed to serve as a Committee to advise the Department of Overseas Trade (Development and Intelligence) on matters relating to the activities of the Department :—

Sir Francis Barker, of Messrs. Vickers, Ltd., representing the Federation of British Industries.

Sir Algernon F. Firth, Bart., chairman of Messrs. T. F. Firth & Sons, Ltd.; director of the British Trade Corporation, representing the Association of Chambers of Commerce of the United Kingdom.

Mr. W. H. N. Goschen, of Messrs. Fruhling & Goschen, merchant brokers; director of the British Trade Corporation, the Atlas Assurance Co., Ltd., &c.

Mr. W. L. Hichens, chairman of Messrs. Cammell, Laird & Co., Ltd., director of Coventry Ordnance Works, Ltd., &c.

Lord Inchcape, G.C.M.G., chairman and managing director of P. and O. Steam Navigation Co., &c.

Mr. Water Leaf, chairman of London County and Westminter Bank, Ltd., deputy chairman of Central Electric Supply Co., Ltd., chairman of St. James's and Pall Mall Electric Light Co., Ltd.

Mr. Kenneth Lee, of Messrs. Tootal, Broadhurst, Lee & Co., Ltd., director of British Dyes, Ltd.

Mr. G. A. Moore, of Messrs. Holt & Moore, merchants, Liverpool; director of Niger Co., Ltd., chairman of the Executive Merchants' Committee of the Liverpool Chamber of Commerce.

Mr. J. W. Murray, of Messrs. Ker, Bolton & Co., merchants, Glasgow; chairman of the Glasgow Chamber of Commerce.

Sir George A. Riddell, Bart., chairman of the Newspaper Proprietors' Association.

Mr. C. V. Sale, of Messrs. Sale & Co., merchants and shipowners, deputy Governor of the Hudson Bay Co.

Capt. Albert Smith, M.P. for the Clitheroe Division of Lancs.

Col. Frank H. Wedgwood, of Messrs. Josiah Wedgwood & Sons, Ltd., chairman of Industrial Council for the Pottery Trades.

Catalogues and Lists.—Messrs. Higgs Bros., Summer Hill Street, Birmingham.—Stock list of standard shunt-wound ventilated motors.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—New edition of their "Book 5," containing full and illustrated description and prices of their electric clocks, sound signals, and synchronisation of existing workmen's clocks. The issue of this new (60 pp.) catalogue, in which are embodied all the latest improvements and additions to the firm's "Pulsynetic" system, has been necessitated by the increasing demand for correct and uniform time throughout munition works, shell-filling factories, and other large works.

Messrs. E. Bennis & Co., Ltd., 28, Victoria St., London, S.W. 1.—Sixty-four-page finely-illustrated catalogue showing and describing their various types of coal and ash plant for coal transport, coal storage, ash transport, and shell transport. Copies will be sent on application.

Bankruptcy Proceedings.—Charles Damey, electrical engineer, 24, Upper Marylebone Street, W., formerly trading at 1, Wardour Mews, Wardour Street, W., under the style of Easthope and Co.—The public examination was held on April 17th, before Mr. Registrar Hope, at the London Bankruptcy Court. The accounts showed liabilities £829 (unsecured, £755) and assets "nil." In reply to the Official Receiver, the debtor stated that from 1909 to August, 1913, he was partner in the firm of Kingolite Co., electrical engineers. At the latter date the business, together with that of another firm, was purchased by the Kingolite Co., Ltd. Witness received £1,200 in shares as consideration for his interest in the business; he subsequently acted as director of the company without fees, and as its works manager at a salary. He resigned office at the beginning of 1915, and in April of that year commenced business on his own account at 1, Wardour Mews, under the style of Easthope & Co. Early in 1916, witness secured contracts from the Ministry of Munitions, the bulk of which were passed on by him to another firm for execution on a commission basis, he being employed by the firm as consulting engineer, but in consequence of faulty work done by the firm and delay in delivery, his contracts were cancelled by the Ministry in June, 1916. In the following November the greater part of his plant and effects were seized by a bill of sale holder; subsequently very little business was transacted, and he closed down in August, 1917. Witness attributed his failure to expenses incurred in experimenting with various inventions of his own, to the failure of the before-mentioned firm to fulfil munition contracts, and to liability under a judgment. The examination was concluded.

Mountain, Montague Brown (The Economy Appliances and Engineering Co.), engineer, 66, Victoria Street, S.W.—Last day for receipt of proofs for dividend, May 3rd. Trustee, F. W. Davis, 95-97, Finsbury Pavement, E.C. 2.

Felgate, A. E., & Storey, W. (Felgate & Storey, electrical engineers), Reading.—Last day for receipt of proofs for dividend, May 4th. Trustee, E. W. J. Savill, 14, Bedford Row, W.C. 1.

Liquidations.—Electric Lighting and Engineering Co., Ltd.—Meeting of creditors at 43, Castle Street, Liverpool, on May 9th. Liquidator, R. T. Langdon.

Carbonoid, Ltd., Eldon Street, London, E.C.—Liquidator (Mr. H. de V. Brougham) released April 15th.

Football.—On Saturday last, the Ladies' Football Team connected with the Dagenham Works of the Sterling Telephone and Electric Co., Ltd., who have an undefeated certificate, at Southend-on-Sea, on behalf of the three War Hospitals at the Essex seaside resort, met the undefeated Vickers Ladies (Crayford and Dartford), a very fine game resulting in a draw of two goals each.

Electric Welding in Italy.—An exhibition of electric welding processes was given recently at Milan, on the suggestion of Signor Bignami, the Under Secretary of State, under the conviction that the present time in Italy affords a suitable opportunity for displacing acetylene welding, there being a demand for greater supplies of carbide of calcium for the manufacture of nitrogenous manures. Moreover, difficulties of transport militate against the use of the latter, as do the risks attending packing, &c. An agitation in favour of electric welding is, consequently, to be promoted throughout the kingdom.

Patents and Alien Enemies.—Application has been made by Mr. E. E. Greville to the Board of Trade to avoid or suspend Patent No. 6,424/09 granted to Thompson (Ges. für Drahtlose Telegraphie m.b.H.) in connection with electrical oscillations.

Book Notice.—Messrs. H. K. Lewis & Co., Ltd., of 136, Gower Street, London, W.C. 1, have issued a catalogue of their college text-books and works of reference on chemistry, engineering, physics, &c.

Trade Announcement.—Owing to shortage of staff, the Electric Street Lighting Apparatus Co. have decided to close their London office at 11, Victoria Street, S.W. 1. All communications should be addressed to the works, the Foundry, Canterbury. Telephone, 17 Canterbury.

Sweden.—A new electrical engineering undertaking has lately been formed at Malmo, with minimum and maximum capitals of respectively £7,000 and £21,000 and the title the Elektriska Fabriks Aktiebolag.

LIGHTING AND POWER NOTES.

Belfast.—Economies.—The Corporation is about to introduce drastic economies in public and private lighting and in the tramway system by earlier closing hours for business and pleasure places, and the reducing of tramway services, especially on Sundays. The renewal of the economisers and boiler tubes at the generating station having become necessary, the makers, Messrs. Green & Sons, tendered at £756 10s., Messrs. Mannesmann Tube Co. for the tubes, and Messrs. Babcock & Wilcox for the skilled labour. The whole, costing over £1,300, is to be carried out at once. At the recent L.G.B. inquiry into an application by the Corporation for sanction to raise a loan of £310,705 for the purpose of building a new generating station and extending the electric lighting of the city, Sir John Snell was examined regarding its necessity. He expressed the opinion that in some cases temporary buildings would be possible if all building material were not forthcoming. Alderman John Tyrell remarked that if Belfast Corporation had taken Sir John Snell's advice in 1914, not only would the new power station have been in operation, but about £100,000 would have been saved on the transaction.

Birmingham.—Revaluation.—The Overseers have caused a revaluation to be made of the Corporation undertakings, resulting in the following increases:—Electricity, £38,907; gas, £6,551; tramways, £10,000.

Bootle.—Linking-up.—The T.C. has agreed to the proposal for an interlinking of the Bootle and Liverpool electricity undertakings and for a bulk supply by the Liverpool Corporation to Bootle.

Bury St. Edmunds.—The T.C. has offered to supply energy for lighting and power to the works of Robert Boby, Ltd., at 2d. per unit, provided the firm pays £400 towards the cost of mains, &c. The anticipated minimum consumption is 150,000 units per annum, and the capital outlay to give supply, £800.

Continental.—France.—The Compagnie Electrique de la Loire et du Centre has recently established a new electricity generating station with an annual capacity of 30,000,000 kw.-hours, to utilise the water power of the Besbre Falls on the River Loire. The power generated will be transmitted to Roanne for use in connection with the arsenal at that place, supplementing that drawn from the Chatel Montagne Station at La Voudriat.

Sweden.—A new company has lately been formed at Lillpite, with the title Lillpite Elektriska Kraft Aktiebolag, to establish a small electric power plant in that town.

Crompton.—Prov. Order.—At a special meeting of the U.D.C., last week, it was reported that the Board of Trade had written stating that, pending any action that might be taken as a result of the report of the Coal Conservation Sub-Committee and the Electric Power Supply Committee, they were unable to proceed with the application of the Council for a Provisional Order for electric lighting in the district. If in the light of any recommendations it was found permissible to entertain a fresh application, the Board would be prepared to consider the matter without further fee. Councillor A. Clegg, J.P., the chairman, said the Council should enter an emphatic protest against the Board of Trade's attitude, and point out that the main difficulty—that of laying a cable—was being got over by the installation of a cable for Government purposes in the district, and that it was essential that their request should be granted. It was decided to send a strong letter of protest.

Fuel Economy.—It is stated in *The Times* of April 18th that where new appliances consuming gas have been put into use by their customers since March of last year, the South Metropolitan Gas Co., on application, will assess the additional amount of gas that may be used; electricity consumers, therefore, who are in a similar position, and are unable to reduce their consumption by one-sixth, should apply to their respective suppliers for guidance in this matter. Persons holding contracts for Government work, whose businesses are not controlled, and who cannot comply with the regulation, should apply to the Board of Trade for licences to exceed the limits specified. The Board, it is stated, will give very sympathetic consideration to cases where the compulsory reduction presses hardly on consumers who had already, by rigid economy, reduced their consumption to the minimum, and as the object of the order is to save coal, favourable consideration will be accorded to consumers whose use of electricity exceeds the rationed quantity if they can show that the consumption of coal for the household has been correspondingly reduced, as, for example, by the adoption of electric cooking.

Iceland.—Hydro-Electric Scheme.—It is reported from Copenhagen that at a meeting held there of the Norwegian-Icelandic Co., Titan, it was decided to erect six hydro-electric stations for the utilisation of the Tjordsaa, which is the largest river in Iceland. It is believed that in this way power exceeding 1,000,000 h.p. would be brought into use, which would form the basis for the development of Iceland as an industrial country. It is proposed, in the first place, to embark upon the fixation of atmospheric nitrogen, and, in the event of the realisation of the scheme, also to construct a railway to Reykjavik of the length of 40 miles.

India.—Koyna River Hydro-Electrical Scheme.—The scheme aims at the establishment of a hydro-electric undertaking for the development on the West Coast of India of one of the biggest combinations of electrochemical industries in the world. The chief industry it is proposed to establish is the electrochemical production of aluminium from bauxite or laterite. The project will provide electric power extremely cheaply, and therefore a variety of industrial schemes—such as the production of nitrogen, iron, steel, and alloys—have come within the purview of Messrs. Tata's investigation. They do not propose themselves to enter into numerous industries of the kind, but their special aim would be to provide electric power and assist industrial experts to start industries depending upon it.—*The Times of India.*

The new electricity generating station at Loyabad, in the Bihar Province, which has been established by the Sijua (Jheria) Electric Supply Co., was recently put in operation. The plant, which is intended to provide the power necessary for the working of the Loyabad, Mudidih, Katras, and Choitodih Collieries, comprises a battery of three Babcock & Wilcox boilers, and two British Westinghouse steam turbines coupled to 2,000-KW. B.T.H. generators. The energy is generated at 6,000 volts, and is transmitted to the collieries by a ring main 14 miles in length. The new plant will displace nearly 200 boilers of various sizes in and around the collieries, and is expected to effect an economy in fuel consumption of approximately 8 0 per cent. It may be added that two of the boilers at the generating stations are coal-fired, while in the third steam is raised by means of the waste gases from the coke ovens at Loyabad.

Lord Lamington, speaking at the Society of Arts, on April 18th, on the development of water power in India, said there were tremendous supplies of water available for power in the southern part of the Bombay Presidency. He thought it would be a good thing if the Government made a complete survey of these and other sources with a view to their utilisation.

Lees (near Oldham).—Extension of Supply.—The U.D.C. has sent a letter of protest to the L.G.B. regarding the refusal to make an order for the extension of the supply of electricity to the district. It was stated it would involve the Council in expense to the amount of £100 if it again proceeded in the matter.

London.—L.C.C.—Loan Sanction.—The Finance Committee recommends the sanction of the Council to the borrowing of £58,000 by the Hackney B.C. for turbo-alternators, boilers, and auxiliary plant, and of £16,680 by the Stepney B.C. on account of expenditure incurred in respect of boilers, plant, and machinery, chiefly under contracts entered into up to September, 1917.

St. Pancras.—*The Daily Chronicle* states that the Council has been asked by the Board of Trade to furnish a fortnightly statement showing the total quantity of electricity generated and consumed.

Hackney.—Loan.—The Finance Committee reports that it has arranged the raising of a loan of £3,500 from the L.C.C. in connection with the linking-up with the North Metropolitan Power Supply Co.'s undertaking.

Barnes.—The Council has considered an application from the Beverley Brook Works for power supply, which will necessitate the provision and laying of an additional feeder cable, and has decided to give the supply subject to the company paying the cost of the cable, &c., and entering into a contract subject to the same conditions embodied in the agreement dated November, 1916.

The Lighting Committee has instructed the engineer to ascertain whether the police authorities would raise any objection if the street lamps were not lighted during the months of May, June, July, and August, except on the omnibus routes.

Mytholmroyd.—Prov. Order.—The B. of T. has informed the U.D.C. that it has been decided not to proceed with the application made this session by the Electrical Distribution of Yorkshire, Ltd., for a Provisional Order in respect of the districts of Luddendenfoot and Mytholmroyd.

Ormskirk.—The B. of T. has extended the time under the Ormskirk Gas and Electricity Act, 1915, for the period of one year.

Pembroke (Co. Dublin).—Supply Restriction.—The U.D.C. has announced that, owing to war conditions, Government restrictions as regards cable, &c., and fuel shortage, no new consumers can be supplied with electricity.

Rochdale.—Price Increase.—Further advances in the price of electrical energy are pending. It is understood that the recommendations are to make the increased charges up to 50 per cent. above the pre-war figure for lighting and 80 per cent. for power. The estimated increase in revenue will be about £5,000 a year. Lighting charges were increased by 10 per cent. in 1916, by a further 15 per cent. in May last, and 8⅓ per cent. in November. The coal clauses have largely regulated the charges for power, but there have been three increases to meet additional charges. It is expected that the deficiency on the works for the past year will be about £3,000, as against the big loss of £13,500 a year ago.

Shanklin.—Proposed Price Increase.—The Isle of Wight Electric Light Co. has applied to the B. of T. for permission to advance the charges for energy to 9d. per unit. The U.D.C. has decided not to oppose the application, but to request the company to agree not to charge more than 8d. without consent.

Shropshire Power Co.'s Bill.—A Select Committee of the House of Lords, presided over by Lord Muir Mackenzie, is considering the Shropshire, Worcestershire, and Staffordshire Electric Power Co.'s Bill, which is being opposed by the Midland Electric Power Co., the borough of Shrewsbury, the county borough of Stoke-on-Trent the Corporations of Walsall, West Bromwich, Wolverhampton, and the city of Worcester, the Association of British Chemical Manufacturers, and the Stourport U.D.C.

Mr. H. Lloyd, K.C., said the Bill would enable electric power to be provided on economical terms to a number of large towns in the Midland counties. The promoters were asking for power to compulsorily acquire a site on the River Severn, just outside Stourport, for the erection of large premises for the purpose of generating electric power, the manufacture of gas used in the generation of electricity, for dealing with residuals resulting from gas manufacture, and the erection of plant for the extraction of nitrogenous products from the atmosphere. The promoters agreed to amend Clause 26, which gave them power to enter into agreements with any distributing company, and all they now asked for was power to link-up with the Kidderminster and Halesowen Electric Traction Companies, and the Birmingham Corporation.

Mr. Madgen, chairman of the company, in support of the Bill, said that since 1908 the capital expenditure had increased from £35 809 to £710,217, and the revenue from £10,425 to £70,108. He did not anticipate any falling-off in the demand for electricity after the war, because electric power was essential to the economical carrying-on of every industry in the country. He proposed to put down plant of 80,000 KW. capacity, with 20,000-KW. stand-by. Mr. David Henry Martin, organiser of the Iron and Steel Trade Federation, said in that area they had suffered through the shortage of electricity. One large works lost on an average 21 hours per week through lack of power from September 10th to January 31st.

Mr. Talbot, K.C., said the joint opposition had no desire to hinder the development of electrical energy in the area, but they were of opinion that the large powers asked for ought not to be conferred, and that the area of supply should not extend northward beyond a line drawn from West Bromwich to Rowley Regis.

Mr. George Bean, chairman of Harper, Sons & Bean, Dudley, Smethwick, and Tipton, was of opinion that something ought to be done to speed up the production of electricity; on several occasions his works had to close down on account of shortage of power. Mr. Charles P. Sparks gave expert evidence in support of the Bill; in his opinion, it was essential that the promoters should have further generating powers, as their plant had been seriously overloaded for the last two years. He considered that the site selected for the new station was admirable in every way, having an adequate water supply and being within easy access to the railway and the coal fields. The Ministry of Munitions was officially supporting the Bill, and had placed a sum of £200,000 at the disposal of the promoters, in view of the importance of the undertaking.

Swansea.—The B.C. has been notified that, owing to unforeseen circumstances, the Harbour Trust will not be in a position, on June 30th next, to take the supply of electrical energy previously arranged for. It has been decided to vary the agreement, the date for the supply to be not later than June 30th, 1919.

Twickenham.—Price Revision.—The Twickenham and Teddington Electric Supply Co., Ltd., has informed the U.D.C. that, owing to the increasing cost of materials and labour, it has been obliged to apply to the B. of T. for its charges to be revised, and to substitute for the existing charges on the maximum-demand system a flat rate of 9d. per unit, with the proviso that the charge shall not exceed 8d. without the Council's consent. The Council has decided to object to the application.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Tramways Sale.—The T.C. has authorised a notice to be served upon the Oldham, Ashton, and Hyde Electric Tramways Co. requiring the company to sell to the Corporation so much of the undertaking as is within the borough.

Bradford.—Wages.—The award of Mr. J. B. Baillie, umpire in the arbitration between the Corporation and its employés, has been issued. The average bonus was 16s. per week over pre-war rates, and the workers demanded that it be £1, that men and women be paid alike for similar work, and that double time be paid for Sundays and Bank Holidays. The award gives general officials, clerks, inspectors, and collectors an increase of £6 10s. per annum for both men and women. Electricity department clerks receive 2s. per week additional on the existing bonus, and in the tramway department male clerks get 4s. and female ticket clerks 3s. per week. Certain clauses of the award are not clear to both parties, and inquiries have been directed to the umpire. A meeting of employés, last week, expressed keen dissatisfaction with the award, but in the meantime the items which are clear are to be put into operation this week. One of the grievances of the employés is that the tramway workers are entitled to back pay.

Burnley.—Late Car Service.—Tramway workers have accepted the offer of the Corporation Tramways Committee to run later cars if required, on the Committee's undertaking to run special cars night and morning for the convenience of the tramway employés.

Bury.—Fares Increase.—The Corporation Tramways Committee has decided to pay £5,000 to the credit of the borough rate. There was a profit of £4,873 on the Bury section, and on the

Radcliffe section a profit of £370 under the first agreement, and a loss of £395 under the second agreement. It has been decided to increase the fares on the Bury and Radcliffe sections by one halfpenny, new penny stages to the town centre being fixed.

Doncaster.—Fares Increase.—To meet the recently advanced wages to Corporation workers and increased costs generally, the Council in Committee, last week, decided to advance fares on the Warmeworth route from 2½d. to 3d. for the whole journey, and from 3d. to 4d. on the Brodsworth route.

Fuel Economy.—An Order has been issued by the Board of Trade that, south of a line drawn from the Wash to the Bristol Channel, tramways must reduce their coal consumption by 15 per cent.

Glasgow.—The valuation of the T.C. tramway undertaking by the Assessor of Railways and Canals, for the year 1918-19, was reported to be £283,006, against £275,896 for the previous year.

Halifax.—Service Curtailment.—The Tramways Committee has appointed a Special Sub-Committee to consider further curtailment of the service, owing to labour shortage and the difficulties generally in tramway maintenance.

The Corporation tramcar which has been fitted as a travelling kitchen, for communal feeding purposes, and which is probably the first of its kind in the country, has two ovens, six steamers, and a boiler, all electrically heated, and arranged to cook from 800 to 1,000 meals at a time. The current is obtained from the overhead wires. The initial preparation of the food for cooking has to be carried out at one of the ordinary communal kitchens. Purchasers are served at both ends of the car. The actual uses to which the car is to be put are not quite decided, but it will probably serve to ascertain the places where kitchens are needed.

Huddersfield.—Women Drivers.—At a meeting of the T.C., last week, it was stated that the tramway manager had been instructed to make inquiries, and, if satisfactory, have a few women trained as tramcar drivers.

Leeds.—Fare Increase.—A scheme has been approved by the Tramways Committee for the abolition of ½d. tramway fares and the increasing of all other fares. The changes are based on a 1d. fare for 1 mile, and all 1d. fare stages will run consecutively from the centre to the termini, and will not overlap.

London.—L.C.C.—Wages.—The Highways Committee reports that the Committee on Production has stated that, if it is intended that the provisions of the award of March 8th (Tramway and Motor Omnibus Workers) relating to women should be applied in the case of the female employés of the Council's tramway undertaking, its view is that the war wages of those women of 18 years and over who have received the same war advances as male employés should be increased to the same extent as the men's, and that those women 18 years and over who are receiving less should be paid an advance of 4s. a week, the necessary further advance to be paid to such women when they have completed 12 months' service. This ruling is being acted on in applying the agreement, and the effect is that about 67 per cent. of the women will receive an immediate advance to £1 a week.

During the three months ended March 31st the Highways Committee has settled 940 claims against the Council in respect of accidents arising in connection with the working of the tramways, at a cost of £9,186. In 16 other cases, seven resulted in the Council's favour; in six the verdict was against the Council, and £311 and costs had to be paid; three cases were withdrawn.

Accident.—The *Times* states that a London United Tramway Co.'s car, proceeding through Brentford towards Hammersmith, overturned in the High Street, near the gasworks, on Sunday. Eleven persons were injured, the conductor the most seriously. The roadway was blocked for some time.

Light and Power Economies.—The *Daily Telegraph* states that a number of reductions in the train services on the Underground Railways will shortly take place during the slack business hours and after 11 p.m. In addition, commencing May 1st, a number of stations will be closed after 11.30 p.m. at night. On Sundays, commencing May 5th, certain stations will be closed all day. The Temple and Post Office Stations will be closed after 4 p.m., and Clapham Road will not be opened before that time.

Lowestoft.—In the *London Gazette* for April 19th official notice is given that under Sec. 41 of the Tramway Act, 1870, as the Lowestoft Corporation has for three months discontinued the working of part of Tramway No. 2 (Act of 1901), between Lowestoft North Station and Lowestoft Borough Boundary, "such discontinuance not being occasioned by circumstances beyond the control of the promoters," the powers of the promoters respecting it are ended as from April 11th, 1918.

Yorkshire.—Fares Increase.—The Yorkshire (West Riding) Electric Tramways Co., Ltd., announces a general increase of fares as from April 22nd. Stages are unaltered, but the minimum fare is increased from 1d. to 1½d., and other fares are increased by ½d. Workpeople and children's fares will be half ordinary fares, with a minimum of 1d. School children's return tickets and passes are withdrawn.

Rochdale.—Year's Working.—The results of the past year's working of the Corporation tramways show a net surplus of £8,351, as against £1,773 in the previous year, £3,609 in 1915-16, £4,284 in 1914-15, and £8,489 in 1913-14. The receipts were £108,472, an advance of £17,660, but working expenses increased by £6,195, and capital charges show an increase of £5,824. Half wages to men on Service and war bonuses amount to £8,495. The Committee is asking the Finance Committee to allocate the whole of the surplus to the renewals fund, which will then amount to £32,273. The sinking fund now amounts to £148,029, and the total capital outlay of the undertaking to date is £367,632.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyor, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

Newport (Mon.).—May 2nd. Electricity Department. E.H.T. and L.T. switchgear. See "Official Notices" April 19th.

Plymouth.—April 29th. Corporation. Turbo-alternator, converter, transformers, and switchgear. See "Official Notices" April 12th.

Redditch.—May 13th. U.D.C. Turbo-alternator, cooling tower, switchgear, water-tube boiler, &c. See "Official Notices" to-day.

Spain.—Tenders were recently invited by the municipal authorities of Don Benito (Province of Badajoz) for the concession for the electric lighting of the town during a period of eight years. Not a single offer was, however, received.

The municipal authorities of Levida are at present inviting tenders for the concession for the electric lighting of the town.

CLOSED.

Government Contracts.—List of new contracts placed in March, 1918.

X-Ray apparatus.—H. W. Cox & Co., Ltd.; A. Lyon & Wrench, Ltd.
Motor converters.—Bruce Peebles & Co., Ltd.
Dynamos.—H. T. Boothroyd, Ltd.; City Electrical Co.; Electric Construction Co., Ltd.
Generating sets.—Belliss & Morcom, Ltd.; Browett, Lindley & Co., Ltd.; City Electrical Co.; Crossley Bros., Ltd.
Magnetos.—Fellows Magnetos Co., Ltd.
Motors, &c.—British Thomson-Houston Co., Ltd.; E. Brook, Ltd.; City Electrical Co.; Electric Construction Co., Ltd.; F. Parkinson & Co.
Switchboards and spares.—British Thomson-Houston Co., Ltd.
Transformers.—Foster Engineering Co., Ltd.

India Office. Store Department.

Armature.—General Electric Co., Ltd.

H.M. Office of Works.

Engineering services.—Aircraft Stores Depot, Regent's Park.—Electric wiring.—S. Reed & Sons.

Post Office.

Protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telegraph apparatus.—British L.M. Ericsson Manufacturing Co., Ltd. Tyler & Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—Hackbridge Cable Co., Ltd.; New Gutta-Percha Co., Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.
Dry cells.—British Ever-Ready Co., Ltd.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.
Glow lamps.—Edison Swan Electric Co., Ltd.
Enamelled copper wire.—London Electric Wire Co. & Smiths, Ltd.
Soft copper wire.—British Insulated & Helsby Cables, Ltd.

London.—L.C.C. Highways Committee. Three months ended March 31st. Accepted tenders:—

Rewinding armatures for electric tramcars—

P. R. Jackson & Co.—£166.
H. Dunn & Son.—£359.
Electrical Repair Co., Ltd.—£392.
Burdette & Co.—£808.
Collins Electrical Co., Ltd.—£323.

Steel and iron supplies—

32,720 chain-grate stoker links, £735.—Babcock & Wilcox, Ltd.
620 tons conductor tee rails, £11,626.—Frodingham Iron & Steel Co., Ltd.
2,250 driving wheel tires, £7,973; 1,500 pony wheel tires, £4,706.—Henry Bessemer, Ltd., and Cammell, Laird & Co., Ltd.
500 tons brake shoes for tramcars, £6,875.—Pease & Partners, Ltd.

Cotton-covered copper wire, Class T 6 B.—

Midland Electric Wire Co.—Items 2, 4, and 5 (50 per cent.), approximate value of contract, £2,515.
British Insulated & Helsby Cables, Ltd. Items 1, 3, and 6 (whole); 2, 4, and 5 (50 per cent.), approximate value of contract, £4,436.

Stores and Contracts Committee. Accepted tenders:—

Electric insulating material. Schedule 15, for 12 months—

G. Haltersley & Sons, Ltd.
Hooper's Telegraph & India-Rubber Works, Ltd.
G. MacLellan & Co.
Micanite & Insulator Co.
J. Thompson.

Electric lamps. Schedule 17—
Cryselco, Ltd.

Electric traction glow lamps. Schedule 17D—
Siemens Bros. Dynamo Works.

During the quarter ended March 31st last. 25.225 tons of coal and 773 tons of coke has been purchased for use at the Greenwich power station, at a cost of about £46,000.

Luton. — Electricity Committee. British Thomson-Houston Co., Ltd. Two 1,000-KW. converters, £8.004 : switchgear, £489.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, April 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Institution of Electrical Engineers.—(Students' Section).—Friday, April 26th. At 7 p.m. At University College, Gower Street, W.C. Paper on "Electric Arc Furnaces," by Mr. J. A. Broughall.

Junior Institution of Engineers.—Friday, April 26th. At 7.30 p.m. At 39 Victoria Street, S.W. Paper on "Refrigerating Chambers and Heat Insulation," by Mr. E. C. West.

Friday, April 3rd. At 7 30 p.m. Paper on "Power Plants: National, Communal, or Industrial," by Mr. W. A. Tookey.

(**North-Eastern Section.**)—Tuesday, April 30th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Papers on "Synchronous Clocks," and "The Soldering of Aluminium."

Institute of Metals. Thursday, May 2nd. At 5.30 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Lecture on "The Formation of Diamond," by Hon. Sir C. A. Parsons, K.C.B., F.R.S.

Institution of Mechanical Engineers.—Friday, May 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on the paper "Employment of Women in Munition Factories."

NOTES.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, S.W., on Friday last, when there were present :—Messrs. Ullmann (East Ham), chairman ; W. E. Hammond (Met. Electric), vice-chairman ; Slattery (West Ham) ; Schofield (Leyton) ; Murray (Walthamstow) ; Mason (South Met.) ; Harvey (Ilford) ; Mackinnon (London United) ; Birkett (Southend-on-Sea), and Goodyer (Croydon), hon. secretary. Letters of regret at their inability to be present were received from Messrs. Bruce (L.C.C.) ; Williams (Erith), and Stokes (Bexley Heath). Various matters of interest were discussed.

The Decimal and Metric Systems.—In continuation of the special articles on "After-War Trade," the *Board of Trade Journal* last week dealt with the questions of decimal coinage and the metric system of weights and measures. The Departmental Committee on the Engineering Trades states that :—

"There is no demand from the side of the manufacturer for the abandonment of the inch measure and pound weight and the compulsory adoption of the metric system, although some already use the latter without difficulty for their own convenience. There are also two strong reasons among others against any change at the present time : first, that the expense of the change would be so great in replacement of measuring instruments, lathe screws, &c., that the trade could not bear it at a time when its recuperative powers will be so severely taxed ; and, secondly, that if the change is ever made, it should only be after consultation and agreement for identical action with our Dominions and the United States, and also, if possible, Russia.

"The foregoing remarks apply only to the inch measure and pound weight as basic measures, and not to the divisions or multiples based on them. We think it desirable that the division of the inch into one-eighth, one thirty-second, and one sixty-fourth should be abandoned altogether in favour of the division into hundredths, which is already used exclusively for high-class work.

"The hundredweight and ton should be replaced by the cental and short ton of 100 and 2,000 lb. respectively, the latter in conformity with American practice. The change would simplify invoicing and freight charges, and would be less mystifying to the foreigner.

"We would approve of a similar change in coinage if it were within our terms of reference, and provided that the pound sterling were retained as the unit of value for all purposes. We do not consider the dollar a suitable unit. The absurdity of such a complication as 73 tons 13 cwt. 3 qrs. 17 lb. at £11 17s. 6d. a ton is obvious, and great saving of time would result, both in work and education, by the adoption of decimal notation in connection with our present bases of measure and coinage."

The Committee on Shipping and Shipbuilding is not of opinion that an increase in our business with foreign clients is prevented by our insular units, in shipbuilding and marine engineering. A number of witnesses, as well as the majority of the firms, in replying to the form of inquiry addressed to them, expressed themselves in favour of the compulsory adoption of the metric system as tending to simplify calculations and facilitate business with foreign countries. But the Committee adds :—

"We have reason to think, however, that some of the firms did not clearly distinguish between the metric system and a decimal system, which could be applied equally to the English units of weight, measure, or value. The witnesses whom we consulted, while strongly in favour of making calculations in decimals, were divided on the question of introducing the metre as the unit of measurement."

As regards foreign business, clients in the British Dominions and the United States all use the British scale of linear measure ; while even in other countries, the Committee was informed, there is said to be no difficulty with regard to the use of the foot and the inch. Further, this Committee urges :—

"It was pointed out to us that, apart from the inconvenience involved in the change of habit, all existing patterns, dies, jigs, gauges, &c., would be more or less useless both to designers and to the men who work to the designs. The majority of the witnesses were of opinion that this would involve considerable cost. If, in addition, a system of screw threads based on the metre were adopted, this would also include the probable scrapping of change gear wheels of lathes.

"In book-keeping and in the payment of wages, calculating machines now in use reduce the inconvenience of our monetary system, if any, to a minimum. In the works, feet, inches, and sub-divisions of inches, *i.e.*, halves, quarters, eighths, sixteenths, thirty-seconds, are used without inconvenience ; and for the finer work, one-hundredths to one-thousandths of an inch are used without difficulty.

"So far as shipbuilding and marine engineering are concerned, we see no reason for the change. That part of the metric system involving the decimal sub-division of time and the right-angle is most objectionable, and if adopted would most seriously prejudice the interests of navigation."

The Committee on the Textile Trades found among individual witnesses a decided predisposition in favour of the metric system, but rather as a counsel of perfection than with a view to its immediate adoption in this country. The idea of a common system of weights and measures for the whole commercial world is very attractive, the Committee states, and it is only when the practical difficulties in the way of its adoption come to be realised that the feeling in its favour begins to cool down. In the case of the textile trades, it is added, these difficulties are very serious indeed :—

"The great British textile trades—and more particularly the cotton trade—are so predominant in the world that similar industries in other countries have had in the main to follow their lead and to accept their technical standards. All our textile machinery in this country, and in most of the countries supplied with British machinery, is based upon British measures, and, as it would be too costly to alter it, it would obviously take many years to replace it, during which period spare parts would have to be provided in the whole measurements, while all new machinery would be based upon metric measurements."

In point of fact, both exporters and manufacturers in the British textile trades, when trading with countries which use the metric system, do habitually quote in metric weights and measures, and deliver goods in these measures, whenever they are asked to do so ; and it is doubtful, in the opinion of the Committee, whether any textile trade is lost either to this country or to the United States by the maintenance of the present system. The Committee, therefore, states in conclusion :—

"While agreeing that a universal system of weights and measures would be a source of great convenience and would facilitate international trade, we do not think it is practicable at the present time so far as the textile trades are concerned. If and when it does come, it can only be adopted by this country with the full concurrence and co-operation of the British Empire and the United States of America. Meanwhile, as a step in advance, we recommend the simplification of our present weights and measures and the decimalisation of our money."

Electric Power Supply in Scotland.—A conference of representatives of municipal electrical undertakings in Scotland, called to consider several important questions concerning electrical supply, was held recently at Edinburgh, under the presidency of the Lord Provost, Sir J. Lane MacLeod. It was resolved to form an Association representative of Scottish electrical undertakings, and a provisional Committee was appointed to draft a constitution for the Association.

Dr. Ferranti's Cotton-Spinning Patent.—In the King's Bench Division, on Tuesday last, Mr. Justice Sargant again had before him a petition in the matter of Letters Patent granted to Dr. S. Z. de Ferranti for improvements in relation to spinning, twisting, and doubling machinery. The case was mentioned in our issue of April 12th. In giving judgment, his Lordship said that for the last 25 or 30 years the main features of spinning or twisting had been stereotyped, and the machinery in this process had been brought to an almost inconceivable pitch of refinement and accuracy, but there were features which imposed an insuperable limit to the speed of production. The inventor, Dr. Ferranti, set to work to solve the problem of obtaining a much greater speed, and he proposed to obtain the required result by using a turbine, driven by compressed air, to rotate each separate spindle. He claimed that his invention would get rid of the difficulties which had imposed limitation on the speed of working, and, in all the circumstances of the case, his Lordship came to the conclusion that the extension of monopoly rights should be granted for seven years. With regard to the relative position of the inventor and Messrs. Coats, Ltd., under an agreement the company were to have an exclusive licence in the United Kingdom and abroad for manufacturing thread, sewing cotton, and the like, the rest of the patent remaining the property of the inventor.

Decimal Coinage.—On Wednesday, on behalf of the Association of Chambers of Commerce, Lord Southwark presented to the House of Lords a Bill for the adoption of the decimal system of coinage in this country. It is proposed that the existing silver, copper, and bronze coins should be abolished, and their places taken by coins each of which would be a "thousandth part, or the multiple of a thousandth part, in value of a sovereign."

Foreign Trade.—The March Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

Imports.	*March,* 1918.	*Inc. or dec.*	*3 months,* 1918. *Inc. or dec.*
Electrical goods ...	66,348	− 69,046	− 165,615
Machinery	853,499	+ 184,709	+ 750,663
Exports.			
Electrical goods ...	111,007	− 192,764	− 542,559
Machinery	1,136,051	− 732,732	− 1,940,751

Fatalities.—At Tipton (Staffordshire) an adjourned inquest was held touching the death of Alfred Tearne (17), a machine hand, who was found dead while following his employment at the Midland Expanded Metal Co.'s works. On March 23rd the youth was seen clinging to a stay wire connected to a pole bearing electric power wires, and the inquiry had been adjourned for an investigation to be made by a Home Office expert to ascertain whether it were possible for the stay wire to be charged. The electrician at the works, who was recalled, stated that at the time of the occurrence the power wires were looped together by copper wire, which was afterwards tied to the pole, at a distance of 18 in. from the stay wire. Owing to the stormy weather, however, the copper wire had given way and had been replaced by string. Mr. Shephard (for the firm): It has been suggested that the insulated wires touched the stay wire? Witness: That was not so. He added that the three power wires nearest the stay wire were not coupled up at the time of the accident, the motor being in disuse. Mr. G. Scott Ram, Electrical Inspector of the Home Office, said that the number of wires on the two poles was 24; they came from a building close by, at a height of between 7 and 8 ft. from the ground, and were then looped up to insulators on the poles some 10 ft. or more higher. He first looked to see if any of the wires were in contact with the stay wire, but none was in contact. He had the string holding the wires cut away to see what position the wires would take up They did not of their own accord fall against the stay wire, but several of them were quite close to it, and could readily be made to come into contact with it by the shaking of the wires. He then made some tests on the wires to see if the insulating material was sound, and found two faulty places. He could not find that the stay wire could be charged by direct contact with any of the power wires. One of the faulty places on the wires was in a position about where the copper wire would have been, and it was quite possible that the copper wire might have been alive by leakage through faulty insulation on one of the wires at the point where it was bound round. The condition of the wires was generally bad, owing to exposure to the weather for a considerable time. If the tail end of the copper wire, or any part of it, came into contact with the stay, the latter might thus have been made "live." There was also the possibility that the youth climbed the stay and caught hold of one of the faulty parts of the cable. The jury found that the youth died from an electric shock, but that there was not sufficient evidence to indicate by what means.

Building Trades and the 12½ per Cent.—It is now announced in the Press that the Committee on Production recently considered an application for a bonus of 12½ per cent. on earnings made by various Trade Unions on behalf of building trade operatives in the employment of firms who are members of certain employers' associations. By its award the Committee grants, from the first full pay day after April 11th, a bonus of 12½ per cent. on earnings to plain time workers, and 7½ per cent. on earnings to piece workers engaged on constructional or maintenance work, such work being munitions work, carried out by employers in the building trade, whether as contractors or sub-contractors.

Methods of Testing Earth Resistance.—After a series of extended experiments on testing the resistance of earth connections, the Bureau of Standards has come to the conclusion that most of the methods commonly used do not give correct results. A direct-reading portable and fairly reliable means of testing the resistance of earth connections is found in the use of the Kohlrausch bridge method or a modification of it. A separate source of energy may be obtained from a dry cell, and two auxiliary grounds must be available. Actual practice shows that the Kohlrausch bridge method checks with the ammeter-voltameter method to within an average of 3 per cent. The error very seldom approaches 10 per cent. The present-day methods of testing used by many electric companies have been found very unreliable.—*Electrical World.*

Chief Technical Assistants' Association.—The interest shown by chief technical assistants of undertakings in the Provinces since the membership has been extended to all undertakings in the United Kingdom has so greatly exceeded that originally contemplated, that arrangements have been made to relieve the hon. secretary of this section for the time being, and Mr. Parker, chief assistant of the Croydon electricity undertaking, and vice-chairman of the Association, has kindly consented to take over the secretarial duties. It is requested that all communications from members or prospective members outside the Greater London area should be addressed to Mr. J. H. Parker, Electricity Works, Factory Lane, Croydon, Surrey.

Inquiries.—The London address of the Electrical Precipitation Co. (of London) is asked for.

Appointments Vacant.—Fitter for the Morcambe Corporation electricity works; meter inspector and tester (55s. + 12½ per cent.), draughtsman (junior) (50s. + 12½ per cent.), fireman (53s. + 12½ per cent.), switchboard attendants (40s. + 12½ per cent.), sub-station attendants (40s. + 12½ per cent.) for the Greenock Corporation electricity department; shift engineer (70s.) for the Dewsbury Corporation electricity and tramway department; car-shed superintendent (£195) for the Rawtenstall Corporation tramways; sub-station attendant (65s. 5d.) for the Dumbarton electricity works (Electricity Supply Corporation); charge engineer for the Borough of Dover electricity department. See our advertisement pages to-day.

"Safety First" and Illumination.—The London "Safety First" Council has resolved to invite the Central Lighting Authority, through the Home Secretary, to adopt a diffused, substantially uniform illumination in all districts in the Greater London area, where military exigencies and local conditions permit. It was also decided, says the *Times*, to suggest to the lighting authorities in this area that, after the war, the use of appliances should be encouraged to provide diffused street illumination in substitution for the glaring lighting which prevailed before the outbreak of war.

National Electricity Supply.—In a report on the national electricity supply scheme, prepared for the information of the Newcastle Corporation, Mr. Ernest Hatton, engineer and manager of the tramways, whilst agreeing that very great economies of coal can be effected, attacks the Report of the Coal Conservation Committee, on the grounds that the recommendations of the Report are based on misleading and inaccurate data and false premises, that an immense capital outlay would be incurred in addition to the existing investments, that the process of reorganisation would occupy a very long period of years, and that a monopoly of supply would be created, and he urges municipalities to "see to it that their interests and free expansion in the future are properly safeguarded."

Faraday House Scholarships.—On the results of the Scholarship examinations held at Faraday House Electrical Engineering College, Southampton Row, London, W.C., on the 10th, 11th, and 12th of April, the following awards have been made by the Governors of the College :—

To Horace Reginald Harbottle (King's School, Pontefract), a "Faraday" Scholarship of 50 guineas per annum, tenable for three years.

To James Scott Davidson (Penrith Grammar School), a "Maxwell" Scholarship of 50 guineas per annum, tenable for two years.

To Reginald Henry Parkinson (Central Foundation Boys' School, Finsbury), an Exhibition of 30 guineas, tenable for two years.

To Arthur Casswell Harrison (Cranleigh School), a Special Prize of 25 guineas.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following arrangements have been made for meetings of the Newcastle Local Section during May, to be held in the Mining Institute, Newcastle, at 6.45 p.m. :—

May 6th. Informal discussion on "The Proposed Regulations for the Electrical Equipment of Ships," opened by Mr. A. P. Pyne.
May 13th. Annual general meeting and paper by Mr. C. Turnbull on "A British Electrical Proving House."

I.E.E. Council: A New Nomination.—Mr. Thomas Roles, of Bradford, has been nominated for election as a member of Council of the Institution of Electrical Engineers by a number of Yorkshire members.

Institution of Engineers and Shipbuilders in Scotland.—Among the papers down for reading at last Tuesday's meeting at Glasgow, was one by Mr. W. B. Hird on "Electrical Ship Propulsion."

Liverpool Engineering Society.—At the annual meeting on Wednesday evening, Mr. R. Croston read a paper on "Photomicrographic Examination of Metals."

Diesel Engine Users' Association.—At the March meeting of the Association (Mr. Napier Prentice, A.I.E.E., president), the hon. secretary (Mr. Percy Still) made a general statement of the position in regard to tar oil fuel and other fuel oil supplies. Reference was made to the work carried out by the Heavy Oil Engine Fuel Committee which has been appointed by the Controller of Munitions Mineral Oil Production, and particulars were given as to the method of making application for licences to buy tar oil, arrangements for tar oil distribution, various methods of using tar oil, and the granting of priority certificates to enable parts to be obtained to adapt engines for the use of tar-oil fuel.

A discussion on the use of tar-oil fuel in Diesel engines followed, and much useful information was given by several speakers in connection with the development of various devices for burning tar oil, as well as on the subject of the varying nature of tar oils.

The subject, which is of particular importance at the present time in view of the restriction in the imports of petroleum fuel oil, is to be again discussed at the following meeting, when it is expected that further information of interest will be forthcoming.

We have received from the secretary a list of members and subscribers, with particulars of the plant under their charge, objects of the Association, &c.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending May 5th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. D. Bentley.

Next for Duty.—Capt. E. Fleming.

Extract from *Gazette.*—County of London Engineers (L.A.T. Companies): Temporary Major C. B. Clay to be Temporary Lieut.-Colonel (March 27th, 1918).

Inspection.—The Commandant desires to congratulate all ranks upon the excellent report made by the Chief Engineer (London District) on his inspection of the Corps during Easter. He takes the opportunity of thanking the London School of Military Engineering at Esher for the instruction which has enabled them to achieve this result. He trusts all members will endeavour to obtain the recruits necessary to bring the Corps to full strength.

Drills.—All the drills as set out in the quarterly programme will take place as heretofore.

Special Notices.—The Medical Officer will attend for the examination of recruits on Thursday evening at 6.

Recruits will attend for engineering instruction with the Companies.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Capt. Higgins, R.E., has been appointed Adjutant to the County of London Engineer Volunteers (Headquarter, Balderton Street, W. 1). Following active service in France, Capt. Higgins has been, during the past two years, Senior Instructor at the London District Royal Engineer School of Instruction at Esher, where the Engineer Volunteers have carried out practice in heavy bridging, camp arrangements, obstacles, and the use of explosives. The report of a recent official inspection stated that the standard of efficiency reached by the Corps in military engineering was very good, and was due primarily to the instruction provided at Esher, backed by the keenness and enthusiasm of all ranks.

A Projected American Ship Canal.—Dr. J. A. L. Waddell, in the *Scientific American* of March 28th, gives particulars of a proposed ship, sanitation, and power canal, connecting Lakes Erie and Ontario on the American side of the border, which will involve the construction of giant lift-locks.

The total length of the proposed ship canal is about 40 miles, and that of a proposed tributory barge canal about 12 miles. The bottom width of the former varies from 250 to 300 ft., and that of the latter is about 100 ft. The depth of the ship canal is to be 30 ft., and that of the barge canal 12 ft. The total fall between lakes is 327 ft.; of this amount 8 ft. of drop could be utilised at the head of the canal to reverse the flow of the watercourses and the main sewers in Buffalo and Tonawanda, and the remaining height of 312 ft. would be divided between two lift-locks, one of 208 ft., and the other of 104 ft. rise.

The object of the scheme is threefold:—First, to carry the largest lake vessels and barges between Lakes Erie and Ontario in the shortest time and at the least expense. Second, to divert the sewage of the adjacent cities from Lake Erie and the Niagara River, which sewage now seriously pollutes the drinking water of the communities along the banks of the latter. Third, to develop electrical energy to the amount of about 800,000 H.P. The combined heights of the three locks (320 ft.) will produce the estimated H.P. The two main power houses would be located below the lift-locks, and as close thereto as possible.

Each of the large lift-locks proposed will consist of two steel tanks. These will be 660 ft. long by 70 ft. wide (inside measurement), by 35 ft. deep, so as to contain 30 ft. of water without danger of spilling. The inner edges of the two tanks are connected by wire ropes running over a line of 56 sheaves, each 20 ft. in diameter, and each outer edge is similarly connected to a row of concrete counterweights. As the depth of the water in the tanks is to be kept constant at all times, the loads to be raised and lowered will always be counterbalanced as nearly as possible. The three piers of walls for supporting the sheaves are about 280 ft. high, and each varies in thickness from 9 ft. to 17·5 ft. The dimensions of each of the counterweight blocks in plan are 18 ft. by 10 ft., and the height would be about 50 ft. if iron used in the concrete, and considerably more if not. There are to be 28 of these counterweights carried by each of the outer walls.

The operation of the lifts would be by electricity, generated in the power houses located in their vicinity. The sheaves would be operated by racks and pinions with reduction gear between these and the motors. The latter are to be placed on top of the piers, which form a platform some 23 ft. wide by 680 ft. long.

Beneath the tanks there are to be large air buffers, capable of bringing the tank to rest from its greatest allowed speed; besides which, there would be self-acting solenoid brakes to check the velocity at the proper places. Locking apparatus would be required to hold the tanks to exact position at top and bottom of travel, and provision must necessarily be made to take care of the effect of the stretching of the wire ropes under load.

Between the gates of the canal and the adjacent gates of the tanks there would be spaces that must be made as small as possible, because the water which at times fills them must be wasted. The water at the higher level would be caught in small reservoirs at the sides of the cutting a little below the elevation of the highest level of the bottoms of the tanks, and from there it would be pumped back into the head-race. The corresponding water at the gates in the tail-race would fall into the sump of the pit, and from there it would have to be pumped out. The pumps would have to be capable not only of dealing with the water wasted at the lower gates but also the greatest amount of rainfall that could reach the said pit. The average height of the bottom of the pit would be about 60 ft. below the surface of the water in the tail-race, and the elevation of the bottom of the sump would be some 25 ft. lower than that of the lowest portion of the pit.

The higher lift-lock would require about ten minutes to raise, and the lower one about five minutes; and it would take several minutes more to raise and lower the gates. Possibly a passage through the higher lift could be made in about 20 minutes, and through the lower lift in about 15 minutes.

Water-power Developments in Canada.—At the Institution of Engineers and Shipbuilders, on March 5th, Prof. J. C. McLennan gave an exhibition and description of kinematograph films illustrative of water-power developments in Canada. He said that to-day Canada was in the midst of another development, widely spread and far-reaching in its extent—namely, the industrial development of the country. Canada was going to be a great industrial country.

The Government had instituted what was called an Advisory Council on Industrial Scientific Research, and one of the first things it did was to set aside a sum of money to enable 40 young scientists every year to undertake industrial research, and also to enable a select number, who had proved themselves by those 40 scholarships worthy of it, to have the opportunity to prosecute some industrial research that would react to the benefit of the country. Consequently there were now thoughout the country in all branches men who would be in a position shortly to take charge of great industrial works. The Government of Canada had given great attention to the development of water power, because there was in Canada to-day measured 21,000,000 H.P. of water power available. In the United States there was 28,000,000 H.P. available. Already 2,000,000 H.P. had been developed in Canada, and water power there was widely distributed.

People did not realise it, but in the Montreal district there was a larger development at the present time than existed on the Canadian side at Niagara. Within 80 miles of Winnipeg as much power could be developed as was developed just now on the Canadian side of Niagara. Within a few miles of Vancouver there was 750,000 H.P. available. He held that the foundation of Canada's greatness was tied up with this power. In Canada 200 tons a day of nitric acid was made out of nitrates brought from Chile, that could be synthesised to-day by utilising the water-power, at but a fraction of the cost at which nitrates were being brought to Canada. Money was simply being wasted on every shipload of nitrate that was brought from Chile to Canada. The Governments of Canada were controlling those water powers, and they were going to supply the power as cheaply as it could be produced, and he thought he might quite safely say that that power would be produced in Canada almost as cheaply as in any country on earth. Now that cheap power had been brought to Canadian industries it was intended to bring cheap fertilisers to the farmer. It was their aim to see that in Canada there were nitrate works established which would ensure in every province a cheap and adequate supply of nitrates.

In the first development of water power the most easily-constructed plants, such as Niagara, were laid down first; then at another stage water was stored up so as to raise the minimum flow at certain points. At the St. Maurice River, north of Grand Mere, there was a dam, very much like the Assouan dam on the Nile. At La Loutre the storage works would result in the creation of the equivalent of a lake some 3,200 sq. miles in area and about 2 ft. deep, taking the water from a drainage area of about 16,000 sq. miles. This would result in rendering available 182,000 H.P. for raising the minimum load at Grand Mere and Shawinigan.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—We tender our congratulations to Mr. R. Stewart Bain, managing director, and Mr. G. W. Partridge, engineer and manager, of the London Electric Supply Corporation, Ltd., who have recently completed 30 years' service in the company. Mr. H. C. Carter, secretary of the company, after 29 years' service, has retired owing to ill-health.

Bury Tramways Committee has received a letter from the Tramways (Board of Trade) Department, suggesting the transfer of the services of Mr. W. Clough, the Bury tramway manager, from the Shipyard Labour Department of the Admiralty to their Committee, and it has been decided to accede to the request, on the understanding that the proposed transference will enable Mr. Clough to devote more time to Bury.

Aylesbury T.C. has increased the salary of the electrical engineer to £250 a year, with a further increment to £275 as from October 1st.

The Dover Corporation tramway staff has presented a gold watch and a smoker's outfit to Mr. Goodchild, inspector, on his retirement after 20 years' service.

Mr. William Donaldson, chief traffic assistant to the Hastings Tramways Co., on leaving to take up military duties, has been presented with a silver wrist watch and a cheque by the manager and staff.

Mr. S. Hann, borough electrical engineer of Stoke Newington, is now a full lieutenant in the Army.

Mr. George Ollier, assistant electrical engineer at Bispham, Blackpool, and formerly of the Blackpool electricity works staffs, has taken up duties as resident engineeer and manager of the electricity works at St. Andrew's, Fifeshire. He served through the Gallipoli campaign with the signalling section of the Royal Naval Division.

Mr. R. Taylor, a member of the staff of the Leeds tramway department has been presented with a gold watch on his transfer from the Headingley depot to the Beckett Street depot at Leeds

Dover T.C. has appointed Mr. Robertson, of Rawtenstall, as works superintendent and electrician at £4 10s. a week, and has increased the salary of the manager of the electricity works to £260 a year.

Malvern U.D.C. has increased the salary of Mr. S. Trow Smith, gas and electrical engineer, from £400 to £450 a year.

General.—Mr. Thos. Pratt, nominated for election at the forthcoming Chester Conference as the new president of the National Chamber of Trade, is head of the firm of Christopher Pratt & Sons, Ltd., electrical furnishers, of Bradford.

The Highways Committee of the L.C.C. has reappointed and reconstituted its Special Sub-Committee on Tramways Operation as follows:—Mr. W. H. P. Gibson, Mr. G. M. Gillett, Mr. H. H. Gordon, Mr. F. C. Harrison, Mr. D. Hazel, Mr. T. F. Hobson, Mr. H. Marks, Lieut.-Colonel E. W. Morrison-Bell, and Mr. W. J. Squires, together with the *ex-officio* members.

Mr. C. Jones, M.I.E.E., has been elected for the third year, president of the Warwick and South Staffordshire Branch of the Association of Mining Electrical Engineers. He was recently appointed consulting engineer to Coombs Wood Colliery Co., Halesowen.

A medal has been awarded by the Government to Frank Osman, of King's Norton, Birmingham, for devotion to duty, initiative, and resource in dealing with the erection of special plant and the maintenance of the electrical installation at a works manufacturing fuses.

Roll of Honour.—Mr. Alfred Edward Nixon, late Leeds manager of the E.G.S. Co., Ltd., of Newcastle-on-Tyne, was killed in action on April 1st. He had been with the firm 16 years, rising from boy to the position he held on joining the Army. He was well known and respected in the Northern Counties. Mr. Nixon joined the Motor Transport, and from there he was transferred into the Dorsets.

Ernest Hall, R.F.C., late electrician employed at Messrs. Harland & Wolf, of Belfast, was killed in an aeroplane accident at Lahore, India, recently.

Capt. Leonard Pickering, R.E., killed in action, was engaged in the test department of Messrs. Dick, Kerr & Co., Ltd., Preston.

Capt. W. K. Armstrong, South Lancashire Regiment, killed on April 11th, was, before the war, a student pupil at the British Westinghouse Co., Ltd., Trafford Park.

Private J. Hopkinson, Sherwood Foresters, reported missing, was in the electrical engineering department of Messrs. Robinson, Brampton, Chesterfield. His brother, Private H. Hopkinson, R.W. Kent Regiment, who was in the same department, is wounded.

Rifleman C. Coulling, who was with Callender's Cable and Construction Co., Ltd., of Erith, has fallen in action.

Private Wm. Carter, Rifle Brigade, who has died of wounds, joined up from the works of the South Metropolitan E.L. Co.

Private C. S. Jefferis, Royal Fusiliers, who has fallen in action, was with Johnson & Phillips, Ltd., Charlton.

Lance-Corporal Wm. Lewis, Notts and Derbyshire Regiment, killed in action, was with Messrs. Taylor, Tunnicliffe & Co., of Handley.

Sergeant J. Feist, Queen's R.W. Surrey Regiment, who has been awarded the Belgian Croix de Guerre for valour, was up to the outbreak of war engaged with the Guildford Electricity Co.

Lance-Corporal A. B. Hutchinson, R.E. (Wireless Section), has fallen in action. Before joining up he was an electrical engineer on the staff of the Leeds Corporation electricity works.

Corporal W. A. Leman, R.E., killed in action, was employed at the Salford Corporation electricity works.

Lance-Corporal H. Wallword, R.E., killed, was employed by the Lancashire Dynamo and Motor Co., Ltd., of Trafford Park.

Lance-Corporal Thomas Dene, Lancs. Fusiliers, who has died of wounds, was employed by Messrs. I. Frankenburg & Co., Ltd., Salford.

Private H. Wade, Manchester Regiment, who has died of wounds, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Mr. L. G. Byng (Grenadier Guards), a director of the General Electric Co., Ltd., and son of the late G. Byng, chairman of the same company, has been awarded the Military Cross during the recent battles on the Western Front.

Second-Lieut. S. B. Westwood (21), Loyal Lancashire Regiment, who has been killed in action, was a member of the staff of the General Electric Co., Ltd., Birmingham.

Co. Sergeant-Major Kellock, a motorman on the Glasgow Corporation tramways, has been awarded the D.C.M. for gallant conduct.

Lance-Corporal A. B. Hutchinson, formerly an electrical engineer at the Leeds Corporation electricity works, has been killed in action.

Second-Lieut. Douglas Ray Dilworth-Harrison, who has been killed, aged 34, was an electrical engineer at Paisley, and before that first engineer on one of the Prince Line steamers.

Obituary.—Mr. R. W. Blackwell.—The following letter has been received:—

"I was deeply grieved to hear of the loss the profession has sustained by the death of Mr. Robert W. Blackwell, and noted with pleasure your appreciative obituary notice testifying to his qualities. I trust that you will allow me to supplement your remarks by a few from one who thoroughly appreciated deceased's kindly treatment of strangers in a strange land.

"My lucky star must certainly have been in the ascendant when I had the good fortune to make the acquaintance of Mr. Blackwell and his brothers, early in 1888, in Allegheny, Pa. These gentlemen were then responsible for the electrical running of the four-mile Observatory Hill Passenger Railway in Allegheny, on which later I spent many happy days and anxious nights.

"This line was a combination of the Bentley-Knight conduit and two-wire overhead systems. The conduit trough in the centre of the track was of wood, with lead and return conductors fixed on opposite sides. The spring contact shoes of the collecting ploughs rubbed along the top edges of these copper conductors.

"The overhead section consisted of lead and return conductors supported by bracket arms on wooden poles on one side of the track, one conductor above the other. The two-wheeled trolley hung on these wires, and trailed from the hood of the single-deck car, being provided with a device which released it if an obstruction was met. On the single-track section, the conductors on the cars exchanged trolleys when passing each other at the turnouts. Wood insulation was used in both conduit and overhead sections. There was no earth return. The change-over from conduit to overhead was made at the top of a 9½ per cent. grade.

"In working this early attempt at an electric street railway, many initial difficulties were experienced and duly overcome. As the two motors on each car were unprotected, one source of trouble can easily be imagined.

"In spite of many set-backs, the three brothers (familiarly known as Bob, Joe, and Frank) retained their optimistic belief in electricity as the best agent for street car propulsion; and, what was better, proved it. A small colony of English mechanics from the North-Eastern Railway Co.'s shops at Darlington, Durham, in addition to myself, have good cause to remember the broad-mindedness and generosity of Bob Blackwell and his brothers: we personally would have done anything for them, and the lapse of 30 years has, I know, not dimmed our respect and appreciation of American gentlemen, for whom it was a pleasure to work.

"Bob Blackwell was, we found, a man of his word, and one ever ready to help and advise those lucky enough to come to him. In having compatriots of men of this type as Allies in the present great struggle, the British nation is indeed fortunate.

"Gus. C. Lundberg, M.I.E.E.

The many friends of Lieut.-Col. Hurlbatt will regret to learn that he was killed in action on March 25th. For some years before the war Mr. Hurlbatt had charge of Messrs. Dick, Kerr & Co.'s interests in Manchester, and his charming personality gained for him a wide circle of friends and acquaintances. At the outbreak of war he obtained a commission as second lieutenant in the Manchester Regiment, and by his meritorious service had reached the rank of lieutenant-colonel in the same regiment.

Photo by] [Langfier, Ltd.

Lieut.-Col. Hurlbatt—Killed in Action.

Prof. J. Puluj.—The death is reported from Prague, at the age of 73 years, of Prof. Johann Puluj. The deceased, who was a Ruthenian by birth, was formerly Professor of Electrotechnics at the German Technical High School of Prague. He was also an authority on arc lamps and carbons therefor, and the inventor of a lamp bearing his name.

Mr. James W. Garside, electrical engineer to Hebden Bridge District Council died last week. He went to Hebden Bridge from Hull in 1903, when the Hebden Bridge works were established. He was about 50 years of age.

NEW COMPANIES REGISTERED.

Basford Engineering Co., Ltd. (150,176).—Private company. Registered April 17th. Capital, £3,000 in £1 shares. Mechanical and electrical engineers, boilermakers, brewers' merchants, &c. The subscribers (each with one share) are:—Mrs. A. P. Simon, 26, Zulla Road, Nottingham; H. R. Hilton, 1, St. Peter's Church Walk, Nottingham, chartered accountant. The first directors are to be appointed by the subscribers. Solicitors: Acton and Marriott, King Street, Nottingham.

Wicks & Dale, Ltd. (150,174).—Private company. Registered April 16th. Capital, £3,000 in £1 shares. To carry on the business of manufacturers of metal tubes, pipes, and appliances, &c. Agreement with B. W. Wicks and H. L. Dale. The subscribers (each with one share) are:—B. W. Wicks, 60, Queen Victoria Street, E.C. 4, engineer and merchant; H. L. Dale, 60, Queen Victoria Street, E.C., engineer and merchant. The first directors are: B. W. Wicks and H. L. Dale. Registered office: 60, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Duncan Stewart & Co., Ltd.—Bond of cash credit and disposition in security (in Scotch form), to secure £120,000, charged on the London Road Ironworks, Glasgow, and adjacent subjects. Holder: Minister of Munitions.

Evans, O'Donnell & Co., Ltd.—Memorandum of satisfaction to the extent of £3,000 on December 31st, 1917, of trust deed dated December 29th, 1900, and supplemental to trust deed dated June 20th, 1916, securing £40,000 debenture stock.

Lancashire United Tramways, Ltd. (87,044).—Capital, £200,000 in £1 shares. Return dated March 12th, 1918. 192,878 shares taken up; £7 paid; £192,871 considered as paid. Mortgages and charges, £546,500 (a further £30,000 of this stock has been deposited as security for possible advances). Deferred debenture stocks, having no charge over the company's assets, £83,330.

Howard Asphalt Troughing Co., Ltd. (69,270).—Capital, £20,000 in 19,000 ord. and 1,000 def. shares of £1 each. 5,007 ord. and 1,000 def. shares taken up; £4,007 paid; £2,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

W. T. Henley's Telegraph Works Co., Ltd.

The annual meeting was held on Friday last at the offices, Blomfield Street, E.C. Mr. George Sutton, chairman and managing director, presided, and, before proceeding to deal with the accounts, he referred to the change which had placed him in the position of chairman. It must be unusual for a retiring chairman who had served a company for over 30 years to be succeeded by one who had gone through the offices of secretary, manager, and managing director as he (Mr. Sutton) had. He could not say all he would like with regard to the value of Mr. Gedge's services to the company during the 30 years in which he had acted as chairman, but he was sure they were all glad of the consciousness he must have that he was relinquishing the chairmanship at a time when the business was on the flowing tide of prosperity. Proceeding to deal with the balance sheet, it would be noticed that the creditors had increased over last year by about £200,000. That was due principally to the provision for special taxation for the year; to some extent to the increased turnover of the business—which was the largest turnover in the history of the company; and to a small extent for increased contingent reserves consequent upon the larger turnover. On the credit side the item of freehold land, buildings, machinery and plant was lower than in the previous year by about £40,000, which was due to the fact that they had been precluded from putting up buildings and extending their machinery and plant during the war, except so far as they had been able to do it for national work. The investments outside the business had considerably increased, entirely due to Government issues which they had taken up. A year ago they held £100,000 in Government issues and war loans; the present figure was roundly £400,000. The directors felt sure that the policy they had adopted of putting all the available resources of the company in the way of cash into Government loans would have the approval of the shareholders. Since the accounts were made up they had invested another £50,000 in war bonds, and they had also taken up a considerable number of Treasury bills. Stocks were down by about £50,000 the actual depletion of commercial stocks was very much greater, but the figure had been brought up somewhat by the large stocks of raw material they had had to hold for Government orders. Coming to the profit and loss account, the depreciation on machinery, £66,000, was a larger sum than had ever been put to that account before, and was due to the extra machinery which they had had to put in for Government requirements, the use of a great deal of which after the war was problematical. On the debit side of the account the income-tax was shown as £28,000, but that did not represent the whole amount which they paid. They must add to it the amount of tax deducted from the dividends, which amounted, roughly, to £16,000, which would make their total income-tax payments £44,000. The profit for the year was £162,867, and if the recommendation as to dividend, &c., were agreed to it would leave £112,000 to be carried forward into the new year, after making all reasonable provisions for contingencies and special taxation. Looking to the progress of the company before the year 1914, in his view the profit which they showed on the present occasion was no larger than it would have been had there been no war and they had had no war work. The commercial progress which the company was making up to 1914 had been stopped by the war. They hoped to regain it. They had an experienced staff, and he thought it could be said that they had as good a chance of regaining their commercial supremacy in the trade as any other industry in the country. If there had been no war, and they had made the profits, they would have had large sums at their disposal for development and extension of the business. The volume of trade after the war was uncertain; the board had their own views about it. For a time there might be a slackness in trade, but whether that would be so or not they knew that the means of output by the industry generally had enormously increased, and it might well be that after the war they might find that the increased means of output might be greater than the increased trade which eventually would come. In dealing with the question of profits, they would forgive him if he referred to the offer which they made to the Government at the outbreak of the war. They then offered to place all the resources of the company at the service of the Government, leaving the amount of payment and profit entirely at their discretion. He repeated that offer to-day, because he wanted to emphasise the fact that they were not "profiteers" in the bad sense of the word. Of course, a trader was in trade for the purpose of making profits. The percentage of his profits in relation to his turnover depended upon his power to sell, and he had to so regulate his profits that he did not decrease his sales. If his profits were too high, inevitably his sales would go down. The point he (the speaker) wanted to make was that the average rate of profit on the turnover during the war in the business was lower than it was in the few years prior to the war, and that, he thought, was convincing proof that in no sense could they be called profiteers. They knew that after the war the increase in taxation must be very heavy, but they must suppose that the Government would be careful how far they burdened industry in that way. Some of them would have no objection if all excess profits made during the war were taken by the State, but after the war, when they had to meet competition and to fight the world for trade, if undue burdens were to be put upon our industries their prosperity was bound to be adversely affected. The undivided profits of their business—and there had been very large profits undivided—had been used for the building and equipment of new factories employing large numbers of hands. The two new factories at Gravesend had been constructed entirely out of undivided profits. Capital and Labour alike were concerned after the war that no undue burden in the way of taxation was put directly upon industry. He had no inclination to criticise the control which the Government exercised over business, and they knew that a certain measure of control would be exercised after the war, but he was sure all business people were glad that the President of the Board of Trade had said that he could not conceive of anyone desiring in the national interests that the industrial interests of the country should be controlled a day longer than was necessary. They felt that themselves. He would like personally to testify to the whole-hearted way in which the workpeople at the factories and the commercial staff had devoted themselves to the national interests during this time of trial. Nearly 1,000 men had left the works and had gone into either the Army or the Navy, and their positions were all open for them when they came back. Concerning those who never came back, he was sure he could say that the company, when the time came, would sanction the establishment of some sort of memorial to show the deep obligation they were under to those men who had given their all for the country. He would like to give them a few figures showing the relationship between wages, taxation, and dividends in the company. During 1917 the wages they paid came to just over £200,000; the taxation came to about the same; the dividends paid amounted to £59,000, and the capital employed was about one and a half million. Those were very interesting figures, and he thought they showed that capital was not being paid an undue proportion of the amount which the business was earning. Coming to the special resolutions, he need not trouble them very much with details, as the matter had been put before the shareholders in the form of a circular. The proposal was a very simple one. They had had undivided profits which they had used in trading on behalf of the shareholders, and they had been successful in that trading. They now proposed to create 200,000 more ordinary shares and distribute them among the shareholders, giving them one new share for every new share which they held, and they could do that without in any way injuring the financial strength of the company. At the same time they were dividing the £5 ordinary share into five shares of £1 each. He did not know of any advantage in doing that except that it gave a freer market for the buying and selling of the shares. They were asking them to pass resolutions for that purpose, and also for the incorporation of the company's tire department as a separate company. That morning their solicitor had informed him that the Treasury had refused to give their sanction to the latter proposal. He (the chairman) did not know the grounds of the refusal; he could not understand how there could be any grounds for it, as they were not asking for any money. The Tire Co. was started out of the resources of the company as a department of the business. It had established a very good reputation for the quality of its work. It had its own works alongside those of the company at Gravesend, it had its own general business manager, its own works manager, and it kept its own accounts. It was a separate undertaking, but the Cable Co. had fathered it during the three or four years of its existence. Its reputation was such that he knew officially, from a Government Department, that its solid tires, which had been used in France and elsewhere, were second to no other tires made by British or foreign manufacturers. They expected to make a great business of that tire department. If it was well managed it would, he believed, become a bigger business than the cable business, but to enable them to work it properly without friction they were determined to make it into a separate undertaking, still controlled by the company. They would make an effort to get the refusal of the Treasury set aside, but even if they could not do so, they would run the business exactly the same as if it were a separate company, and, therefore, they intended to proceed with the resolution of which they had given notice.

Mr. Sydney Gedge, M.A., seconded the resolution. He remarked that he no longer occupied the position of chairman, and that was because he was satisfied that the best interests of the company would be served by having an experienced and able man like Mr. Sutton in that capacity. When he (Mr. Gedge) resigned, he suggested that Mr. Sutton should take his place, and he was sure that if he had not made such a proposition it would have come from all the other members of the board. In 1910, as chairman, it was his pleasure to present Mr. Sutton with his portrait and a fine service of plate, and he well remembered that, in returning thanks for the presentation, Mr. Sutton told them of the great benefit which the company had been not only to the shareholders, directors, and customers, but to the large number of those whom it employed. He also told them that up to that date in the course of 19 or 20 years it had earned dividends amounting to half a million. In the 10 years since they had paid nearly an equal amount as in the first 20 years, and this year the dividend was 25 per cent., against the modest 5 per cent. with which they started in 1891. Those figures showed the great prosperity which the company had enjoyed during the long time he (Mr. Gedge) had the honour of being its chairman. The thing that had struck him in the general management of the company was that there had never been anything in the slightest degree approaching to a "job" in connection with it. Although he had ceased to be chairman, he would still continue to serve it to the best of his ability as a director.

The report was adopted.

The Chairman formally proposed the special resolutions to which he referred in his speech, and they were seconded by Mr. A. M. J. Drysdale, and carried unanimously.

German Companies.

The board of the *C. Lorenz A.G., of Berlin* (telegraph works), recommend the payment for 1917 of a dividend at the rate of 35 per cent., as in the preceding year, and an increase in the share capital from £225,000 to £337,000.

The A.G. Mix & Genest, of Berlin, after allocating £13,000 to depreciation in 1917, as compared with £39,000 in the preceding year, reports net profits of £76,000, as against £86,000. It is intended to pay a dividend of 15 per cent., this contrasting with 18 per cent. in 1916.

The Kabelwerk Wilhelminenhof A.G., of Berlin, whose share capital of £50,000 is held by the Felten & Guilleaume Co., realised net profits of £12,500 in 1917, as against £13,700 in the previous 12 months, when a dividend at the rate of 20 per cent. was distributed.

The accounts of the *Elektro-Nitrum A.G., of Rhina (Baden)*, which is associated with the A.E.G. and the Griesheim-Elektron Chemical Works, show that after applying £71,000 to depreciation in 1917, as against £2,300 in 1916, the debit balance of £25,000 brought forward has been increased to £28,000 on a share capital of £150,000.

The report of the *Kabelwerk Duisburg* states that the undertaking was occupied on national services in 1917, as in the two preceding years. After setting aside £6,000 for depreciation, as against £5,000 in 1916, the accounts show net profits amounting to £80,000, as contrasted with £74,000, and a dividend and bonus totalling 25 per cent. on the share capital of £150,000 has been declared, being the same as in the previous year.

The directors of the *Deutsche Kabelwerke, of Berlin-Lichtenberg*, merely state in their report that the works were well occupied in 1917. After allocating £1,600 to depreciation, as compared with £1,500 in 1916, the net profits are returned at £45,000, as against £31,000, and the dividend is at the rate of 10 per cent. on share capital of £262,000, this comparing with 8 per cent in the previous year.

The Grosse Berliner Strassen Bahn A.G. (Berlin Grand Tramways Co.) reports that the passenger traffic in 1917 increased by 24.4 per cent. over the previous year. The receipts expanded by 23.87 per cent., but, on the other hand, the expenses advanced by 27.29 per cent., and the excessive wear and tear of track and rolling stock rendered exceptional provision for reserves necessary. The amount set aside for depreciation is £44,000, as against £42,000 in 1916, and £440,000 has been placed to the renewal funds, as compared with £320,000 in the previous year. As net profits the accounts indicate a total of £211,000, as against £212,000, and the dividend is 4 per cent. on share capital of £5,040,000, being the same rate as in 1916.

The directors of the *Gesellschaft fur Elektrische Hoch und Untergrund Bahnen, of Berlin* (Berlin Elevated and Underground Railway Co.), report that the passenger traffic increased from 78,700,000 in 1916 to 108,370,000 persons in 1917, which was much greater than in any peace year. It is considered, however, that this exceptional expansion is transitory, as it was mainly due to the scarcity of omnibuses, motor cars, and horsed vehicles. Although the traffic receipts experienced a large augmentation, the working expenses also advanced, whilst at the same time a large sum had to be set aside for subsequent maintenance and renewal charges, the final result being that the year's working was only slightly better than in 1916. The gross profits amount to £485,000, as compared with £367,000 in 1916, and the net profits are £139,000, as against £124,000. It is proposed to pay a dividend of 3½ per cent. on the ordinary share capital of £3,000,000, as contrasted with 3 per cent. in 1916, 4 per cent. in 1915, 4½ per cent. in 1914, and 6 per cent. in each of the two preceding years. The report states that the construction of the line from the triangle to the Nollendorf Platz and the Wittenberg Platz was continued in so far as labour and materials were available.

Para Electric Railways and Lighting Co., Ltd.

Mr. F. M. Voules, presiding at the the annual meeting, said that the dividend of 7 per cent. on the ordinary shares was 1 per cent. better than for 1916. The Brazilian exchange had risen from 12d. to 12 9/16d., and at the moment there were no indications of an adverse movement. In both the tramway and lighting departments the business showed gratifying development. The number of passengers carried on the cars was well in excess of 22 millions, which was a very close approach to the record year 1912. The sale of electric current for lighting and power was 10 per cent. higher than in 1916, and the net receipts in local currency, both of the tramways and electricity departments, constituted a record in the company's history. This was largely due to further economy in operating expenses. The electrical power house, fortunately, remained quite independent of the difficulties inherent to the shipment of coal to South America, as wood was the only fuel used for power generation, with the same eminently satisfactory results already obtained for a number of years. The company had recently strengthened its position as buyers of wood in the local markets by the acquisition of a favourably situated timber estate which would yield enough wood fuel for a considerable period at a low cost to the company.

Johnson & Phillips, Ltd.—The profit on trading accounts, &c., for 1917, after making provision for bad and doubtful debts, and after charging to revenue upwards of £10,000 for maintenance of buildings, plant, &c., was £70,122, plus £18,711 brought forward. Directors', &c., remuneration required £1,888, debenture stock interest £4,949, debenture sinking fund reserve £7,951, second debenture interest £2,500, depreciation on machinery and plant, &c., £12,132, interest on loans £1,549, reserve £10,000, income-tax and excess profits duty £10,574, written off patents £2,725. The dividend paid in April last absorbed £8,750, and it is now recommended that a dividend at the rate of 7 per cent. per annum be paid on the ordinary shares, requiring £12,250, leaving £13,565 to be carried forward. The above transfer to reserve is in order to meet contingencies in connection with the war. Mr. W. Claude Johnson, the founder of the original business, has been appointed chairman in place of the late Mr. R. W. Blackwell.

Alderley & Wilmslow Electric Supply, Ltd.—Total lamp connections increased during 1917 from 1,133 kw. to 1,193 kw. The profit on working was £2,664, against £2,815 for 1916. After deducting £1,635 for interest on debentures and loans, and adding £1,166 brought forward, £1,200 is put to reserve, and £996 is to be carried forward.

Lymington Electric Light & Power Co., Ltd.—Captain K. Pulteney, presiding at the annual meeting, said that the increase in income was due to the efficient management of Mr. C. L. Holman, who was doing the work of both secretary and manager, and working with a reduced staff. The report, which recommended a dividend of 5 per cent. on the preference shares, was adopted.

Oldham, Ashton & Hyde Electric Tramway Co., Ltd.—Dividend of 3½ per cent. on ordinary shares, making 6 per cent. for the year.

Monte Video Telephone Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum, tax free, on the ordinary shares is announced.

Neuhausen Aluminium Industry Co.—It was recently mentioned in this column that the Aluminium Industrie A.G., of Neuhausen, had decided to pay for 1917 a dividend at the rate of 20 per cent., as in each of the five preceding years, and to present to the proprietors gratis shares for £280,000 derived from profits gradually set aside for the full payment of the non-fully paid shares, thus raising the share capital to £1,680,000. The directors' report now states that the installations in France are still under sequestration, although the company was permitted, as in 1916, to provide the money necessary for the maintenance of the mining concessions. The directors complained that the French Government, although the undertaking has been recognised, it is said, by the French Courts as being a Swiss concern, has not removed the sequestration and refunded all expenses. The report mentions that the works in Germany and Austria were kept in satisfactory operation, and the sum of £20,000 had been allotted to the Swiss National Technical High School for electrochemical research work in connection with aluminium. At the recent annual meeting the chairman stated that unless unforeseen circumstances arise it will be possible to cover the entire requirements of the aluminium works in the current year from the deliveries of alumina from the Goldschmieden Chemical Works and the Martin Works.

Electro-Bleach & By-Products, Ltd.—At the annual meeting Mr. H. J. Mackinder, M.P., referring to the effect of the excess profits duty in connection with development companies which had no pre-war standing of profit earning, said that 9 per cent. upon those companies' capital sounded quite a good thing to the general public, but the latter should understand that industrial companies required, for healthy continuance and for reserve provision to meet the uncertainties of the future, a very much larger return upon their capital. For example, their undertaking had almost entirely reconstructed the equipment and mechanical power of the original Electrolytic Alkali Co. of 20 years ago, but it was still necessary to have ample provision in order to march with the scientific, mechanical, and general progress of the times. The Chancellor of the Exchequer should allow to such young and vigorous companies some adjustment with a view to getting relief from the present onerous incidence of the excess profits impost.

Bromley (Kent) Electric Light & Power Co., Ltd.—Mr. F. E. Gripper, presiding at the annual meeting, referred to the somewhat improved results of the year. There had been great difficulties to contend with, and would be even greater ones in 1918. One of the greatest was the Summer-Time Act, which made a difference of 30 per cent. in their output. There were the increased cost of coal, the large increases in wages under the Government order, and the five-sixths rationing order. They would, no doubt, have to safeguard themselves by increasing the price to the consumer, but it would be a matter for consideration whether that would be sufficient to meet the difficulties in front of them. The amount of electricity generated during the present year was practically the same as in 1913, but the expenses connected with it had been £10,300, as against only £7,800 in 1913; that meant a loss equal to 3 per cent. dividend. They were faced with a position in which another equally serious loss was probable.

Vickers, Ltd.—The directors hope that the accounts for 1915 will soon be completed, but the completion of the accounts for 1916 and 1917 must still be delayed for a considerable time. An extraordinary meeting was held yesterday to alter the articles of association so as to give more powers to the directors. It is desired to acquire, establish, or carry on any business or industry, whether manufacturing or otherwise, which may be calculated to be profitable, and to form any company or companies for acquiring any property or rights which may seem directly or indirectly calculated to benefit the company.

West India Electric Co., Ltd.—Total receipts for 1917, $287,211, an increase of $889; operating expenses $159,190, an increase of $15,125. Net profit $128,021, a decrease of $14,237. The large increase in operating expenses is entirely due to accident claims. Four quarterly dividends amounting to $40,000 were paid. Upon concreting the bases of all transmission line poles $2,471 were paid. The lighting lines were extended in Kingston, St. Andrew, and Spanish Town. In consequence of a plentiful rainfall throughout the year, the hydraulic station has been able to supply the necessary power for operating with only occasional assistance from the auxiliary steam station, therefore the coal consumption has been small.

Cuba Submarine Telegraph Co., Ltd.—The total receipts for 1917 were £72,531, and the expenses £19,293. After providing £6,567 for cable repairs and £2,702 for income-tax, there remains £43,970, plus £7,637 brought forward. £10,000 has been added to general reserve, and £2,500 to pension fund. 10 per cent., less tax, is paid on the preference for the year, and 5 per cent. and a bonus of 4s. per share, free of tax, on the ordinary, and £21,907 is carried forward, subject to any claim for excess profits duty. The several cables repaired at the above cost are now in good working order with one exception.

Madras Electric Tramways (1904), Ltd.—The gross profit for 1917 was £27,831. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £8,000 to depreciation and renewal account, £13,522 remains, plus £4,315 brought forward. After paying the preference dividend, and 8 per cent. on the ordinary shares, free of tax, £3,000 is transferred to general reserve, leaving £4,257 to carry forward, subject to excess profits duty, if any. The traffic receipts and the expenditure in Madras show an increase of 10.3 and 6.8 per cent. respectively upon 1916.

British Electric Transformer Co., Ltd.—The accounts for 1917 show a net profit of £22,665, plus £5,781 brought forward. There is to be put to reserve £7,500, and to depreciation reserve £1,500, preference dividend at 6 per cent. absorbs £4,379, 10 per cent. dividend on the ordinary shares requires £8,749, and extra remuneration to directors £1,067, leaving £5,251 to be carried forward. The Treasury having granted permission for the issue of the balance of the shares, these have recently been placed, and arrangements have been made by which shareholders may participate in the purchase.

Lancashire Dynamo & Motor Co., Ltd.—The "Financial Times" states that the company proposes to issue 50,000 new ordinary shares of £1 each at a premium of 7s. 6d., and has received the permission of the Treasury. Ordinary shareholders will be entitled to take up 45,000—nine new ones for each 20 now held—and the staff will be allowed to take up the other 5,000.

STOCKS AND SHARES.

Tuesday Evening.

The Budget was a very pleasant surprise to the Stock Exchange, which had looked for an increase in the income-tax heavier than the Chancellor proposed. Other forms of taxation do not affect to any material extent the markets for purely investment securities, but the announcement that there will be no change in the excess profits duty came as another unexpected "bonus," as one man expressed it. Markets are better, and there is a more confident tone than has been apparent for some time past. It may be that growing familiarity with the Man-Power Bill is robbing the latter of some of its apprehended features. The news from the Front also deserves credit for the happier sentiment in the Stock Exchanges throughout the country.

Cordial support is extended to the earnest recommendation of the Stock Exchange Committee that a settlement should be reached in the case of all bargains still outstanding on account of the moratorium position that was placed in cold storage after the outbreak of war. Shares carried over at the end of July, 1914, and loans on shares that have not been paid off, are still open in places, and the Committee urge that these commitments shall be closed either by the holders selling the shares, or by paying for them. Most of the holders have readily acquiesced in this sensible proposal, and before long there ought to be left nothing but the merest shadow of the financial obligations that yet remain as a legacy from 1914.

Movements in the market for home electricity shares are insignificant. Small falls have occurred in some of the London issues. Citys are ⅛ down, so are County of London and Charing Cross ordinary. The market in the last-named has been a poor one since the reduction of the dividend, and there has been a little selling during the past few days of the other two. With the increase in the income-tax, a few of the pre-ordinary stocks and shares, not only in this department, but in other sections round the House, have given way a trifle, though without making much difference to the nominal quotations. The manufacturing group is also quiet, and business moves sluggishly.

The Budget brought about sharp rises in several cable issues. Once more the attractions of these tax-free dividend payers are strongly emphasised. Globe ordinary, Western Telegraphs, and both the Easterns are good. Shares are more than ever difficult to buy. The rises spread to Oriental Telephones and United River Plate Telephones. Cuba Submarines are 5s. up. The company has done very well in the year just concluded, the gross earnings of £72,500 being £21,000 better than those of a year ago. The dividend on the ordinary shares is maintained at 7 per cent., and the bulk of the increased profit goes in the carry-forward, which is £14,000 up at £21,907, subject to any claim for excess profits duty. The company pays its dividends free of income-tax, and as the yield at the present price is 7¼ per cent. this is equivalent to 10 per cent. on the money, allowing for tax. Manufacturing shares in this group are quiet. Callenders fell 10s. to 17, but Henleys at 19¾ are 5s. up.

Mr. George Sutton made an interesting speech at Henley's meeting last week, at which he announced that the Treasury had refused its consent to the making of the tire department into a separate entity. Why this could not be done he was unable to say, but the directors would endeavour to get the Treasury's refusal altered. The speech is worth reading in full by those who like to hear an experienced man's views concerning trade prospects after the war.

In the foreign group, Brazil Tractions have been rather more active than usual, and are a dollar better at 42. British Columbia Electric Railway preference lost a point, and Anglo-Argentine Tramways 5 per cent. debenture is 1½ down. The Mexican group is also depressed, and, while no quotable changes have occurred, the market for Mexico Tramways, Mexican Light & Power, and Monterey issues is somewhat weaker, in spite of the steady witness to better conditions which are beginning to prevail in Mexico.

The Underground group in the home railway market is heavy. Underground Electric Income Bonds have fallen 2 points to 75, while the 1s. shares are 6d. lower at 4s. 6d. The reason for the decline appears to be simply that investors are weeding out from their strong-boxes such stocks as possess a speculative flavour, having regard to the possibilities entailed by the Man-Power Bill.

Babcock & Wilcox are 1/16 lower at 3¼. British Aluminium have weakened a little. Rubber shares are quiet, despite a rally to nearly 2s. 6d. per lb. in the price of the produce. Armaments have developed greater firmness. The Chemical group remains very steady. With another big rise in tin there has come more animation, accompanied by rising prices, in the various markets connected with the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price April 23, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅝	—	£7 8 0
Charing Cross Ordinary ..	5	4	3¼	— ¼	6 3 1
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3	—	8 6 8
City of London	8	8	12¼	— ⅛	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10½	— ⅛	6 13 4
do. 6 per cent. Pref.	6	6	9¾	—	6 0 4
Kensington Ordinary	6	7	5⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	3	4	3⅝	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

TELEGRAPHS AND TELEPHONES.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94	—	6 7 8
do. Def.	33/6	1½	22¼	—	6 14 10
Chile Telephone	8	8	7⅜	—	5 8 4
Cuba Sub. Ord.	5	7	9¾	+ ¼	*7 3 7
Eastern Extension	8	8	15½	+ ⅛	*5 4 1
Eastern Tel. Ord.	8	8	154	+ ½	*5 4 0
Globe Tel. and T. Ord.	7	7	14½	+ ⅛	*4 17 5
do. Pref. ..	6	6	9¾	— ⅛	6 3 1
Great Northern Tel.	22	24	36	—	6 11 6
Indo-European	13	13	51½	—	6 6 3
Marconi	10	15	3 1/16	+ 1/16	4 17 10
Oriental Telephone Ord. ..	10	10	4 1/16	—	2 10 0
United R. Plate Tel.	8	8	6 15/16	+ ⅛	*5 15 4
West India and Pan.	6d.	6d.	1½	—	*3 6 8
Western Telegraph	7	8	15⅝	+ ⅛	*5 4 1

HOME RAILS.

Central London, Ord. Assented	4	4	62½	+ 1	6 8 0
Metropolitan	1	1	20¼	— ¼	4 18 9
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A" ..	Nil	Nil	4/6	—6d.	Nil
do. do. Income	6	4	75	—2	*5 6 8

FOREIGN TRAMS, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2¾	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	64	—1½	7 16 4
Brazil Tractions	4	4	42	+1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	51½	—1	9 14 2
do. do. Preferred	Nil	Nil	32½	—	Nil
do. do. Deferred	Nil	Nil	25½	—	Nil
do. do. Deb.	4½	4½	58	—	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	35	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds ..	Nil	Nil	86½	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	3¼	— 1/16	4 12 4
British Aluminium Ord. ..	7	10	1 9/16	—9d.	6 8 0
British Insulated Ord.	17½	20	3⅝	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2½	—	6 0 0
Callenders	20	20	17	— ½	5 17 8
do. 5 Pref.	5	6	4	—	6 5 0
Castner-Kellner	22	20	3½	—	5 14 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	—	6 0 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	20½	—	4 18 9
Henley	25	25	19¾	+ ¼	6 6 7
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15⅝	— ⅛	*6 8 0
Telegraph Con.	20	20	42	—	*5 13 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	£5 inc.
a Ammonia, Muriate (large crystal)	,,	£75	£3 inc.
a Bisulphide of Carbon	,,	£28	..
a Borax	,,	£38	..
a Copper Sulphate	,,	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£22 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/-	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/7 to 1/7½	..
g ,, Bars (best selected) ..	per ton	£147	..
g ,, Sheet	,,	£147	..
g ,, Rod	,,	£147	..
d ,, (Electrolytic) Bars ..	,,	£125	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods	,,	£133	..
d ,, ,, H.C. Wire	per lb.	1/4	⅛d. inc.
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/3	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/2	1d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	4/3	1d. inc.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	r W. F. Dennis & Co.

Adoption Abroad of British Engineering Standards.—H.M. Government have recently been in correspondence with the British Engineering Standards Committee on the subject of the extension of the Committee's activities in foreign countries, and of certain new developments now in contemplation. Towards the above objects H.M. Government have assisted the Committee by a grant, in addition to which a considerable sum has been subscribed by the engineering industry itself.

The distribution abroad of the British Standard specifications and reports, if successful, must inevitably lead to a large extension of British trade, and the Committee has applied to H.M. Government to assist in the work of the Local Standards Committees which it is proposed to set up in various foreign countries, notably in Argentina, Brazil, Chile, China, Peru, Portugal, Spain, and Uruguay. It is desired that each Local Committee should have a president as well as a chairman, the former being the British Consular officer, or other Government representative, with some well-known British engineer resident in the country filling the office of chairman. The work of the secretary of the Local Committee will entail keeping the Committee's records, communicating with the main body in London, and circularising local engineers and purchasers, as well as the technical Press, with a view to furthering the adoption of British standards. At the same time, the Committee in London will expect to receive reports as to the extent to which British standards are finding favour in the countries concerned, and whether local conditions make it advisable to introduce any modifications which would be likely to bring about the wide adoption of these specifications abroad.

The Foreign Office have agreed that the services of H.M Consular officers in certain specified localities shall be placed at the disposal of the Engineering Standards Committee to act in an honorary capacity as presidents of the Local Committees, in orde to supervise in a general way the work it is desired to carry on and these officers have been asked to take steps with a view to giving effect to the scheme briefly outlined above.—*Board of Trade Journal.*

Wagon Hoist.—In the description of a 35-ton wagon hoist, given in our last issue, the following errors occur:—On page 363, second line from bottom of column two, 2,000,000 kg. should read 2,000,000 kgm.², and on page 364, fig. 4, Thousands km. should read Thousands kgm., and 1·19 ft. per minute should be 1·19 ft. pe second.

THE OVERSEAS DISTRIBUTION OF ENGINEERING APPLIANCES.

By LEONARD ANDREWS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

No apology is thought to be necessary for presenting to the Institution a paper on a subject that is at the present time of very great national importance, for it is generally agreed that the continuance of Great Britain's present industrial supremacy is mainly dependent upon the standard of efficiency reached and maintained by the engineering profession and trades. Not only does the mere monetary value of engineering products in itself represent a considerable portion of this country's total export trade, but a far more potent factor in the commerce of the Empire is the indirect influence of engineering exports upon all other industries. Every modern industry is dependent for its existence upon a great variety of specialised engineering appliances. Furthermore, every big engineering achievement invariably leads to the establishment and development of numerous other industries.

Experience has shown that the country which carries out any original engineering work abroad usually secures the bulk of the subsequent trade of that country, created by the industries thus established. The British Empire owes its present industrial position to the fact that for many generations this country has been the recognised engineering workshop of the world, though in recent years Germany has made special efforts to undermine Great Britain's long-established lead. It is, therefore, a matter of the greatest national importance that British engineering industries should be fostered and developed to the fullest possible extent, and that, if necessary, State funds or credit should be applied to this purpose.

All who have visited engineering works in other countries—particularly in the United States of America and in Germany—must have been impressed by the fact that, as pure engineering craftsmen, British artisans can more than hold their own with any and all competitors, but that as an economic distributor this country has much to learn both from the United States and from Germany. Great Britain's superiority as a producer of engineering appliances is fully recognised by her competitors, and it would almost appear that both Germany and America—having recognised the strength of this country's position as a producer—decided to concentrate their attention upon improving distribution, and have thereby attained an exceedingly high state of efficiency in that particular respect.

Mere efficiency of production is, comparatively, of little value unless combined with efficiency of distribution. As many of the problems associated with overseas trade are so closely analogous to the difficulties which have been successfully overcome in distributing electrical energy, the past experiences of electrical engineers should enable them to render valuable assistance to the executive officers of the various organisations which at the present time are devoting so much attention to the improvement of British foreign trade.

The attitude of those manufacturers who cater only for trade f.o.r. their own works may be compared with that of a power-plant superintendent who only concerns himself with efficient production at the main bus-bars, and assumes that all questions relating to distribution are beyond his province; and who, moreover, considers that a reliable low-priced supply should be sufficient inducement to the consumer to make his own arrangements for the distribution and application of the service outside the generating station.

Naumann, in his "Mittel-Europa," says:—"In the last 20 years our German industries have assumed a wholly new appearance. Whilst growing they have grown into one another. Through employers' associations, buying arrangements, agreements as to prices and selling areas, a complex system of mutual attachments and dependencies has come into being. . . . This dovetailing of the individual-self into the community-self is what we are pre-eminently able to achieve. . . ."

What Germany claims to have achieved in 20 years, the British Empire has accomplished in as many months. The conversion or aggregation of many thousands of industrial factories in all parts of the Empire into one huge arsenal for the manufacture of war material is, without question, the most remarkable example of the dovetailing, or sinking, of the individual-self into the community-self that could be imagined.

The absence of competition between engineering manufacturers since the outbreak of war has been mainly, if not entirely, due to the fact that the demand for war material has been more than sufficient to keep all of the old-established works, and many new ones, fully employed. It has, indeed, been an illustration of the fact that competition is entirely controlled by the law of supply and demand. It has been demonstrated by electric power supply undertakings that demand can be created to an almost unlimited extent. Therefore, to reduce or eliminate excessive competition, demand should be developed or increased to balance available sources of supply.

There are millions of British subjects working in overseas territories for the benefit of those who prefer to stay at home, who are just as appreciative of, and equally entitled to enjoy, the comforts of modern civilisation as those who are already benefiting by these conveniences. The scope for developing a demand for modern engineering appliances in this field alone is practically unlimited.

The need for more perfect co-ordination between individual producers and between producers and distributors is now freely admitted. There are, however, considerable differences of opinion as to whether the centre of such co-ordination or control should be the State, or some private enterprise such as an association of manufacturers, or, alternatively, some independent trading association.

The objection to private enterprise control is that any such undertaking must depend for its existence upon its profit-earning capacity, and where its aims in this direction conflict with the community interests—and there are bound to be many such cases—the latter will be liable to suffer.

On the other hand, the objections to State control are:—

1. Such control would be liable to stultify individual effort, and since the entire fabric of existing British trade supremacy is the outcome of the work of individual firms and persons, it should be the first essential of any scheme of industrial re-organisation that individual effort be maintained in a state of maximum efficiency at all costs.

2. State control of any one trade or industry would entail the employment of a very large number of Government officials who would generally know much less about the subject than the principals of the firms they would be endeavouring to control. Moreover, it may be anticipated that the efficient co-ordination of the work of such numerous Government officials would prove to be a greater problem than that of co-ordinating the work of the firms to be controlled.

It appears that actual production, at least, should be left to individual effort, and should be entirely uncontrolled, though a closer co-operation between individual producers, such as is being effected by the various trade associations, and is the aim of the proposed trade parliaments, is undoubtedly to be desired. Some more direct control of distribution appears, however, to be necessary, but whether such control should be by the State or by private enterprise is still an open question. It is possible that some combination of State and private enterprise control may eventually prove to be the best solution.

The ideal to be aimed at is a subconscious co-ordination by indirect influence rather than the despotic mandatory control under defined rules and regulations usually inferred by reference to State control.

A symbolic illustration of such an ideal is afforded by the coupling in parallel of alternating-current generators where the sole controlling or co-ordinating influence is that resulting from the mere connection of the generators to common bus-bars. The generators may be of widely varying capacity, and of greatly differing speeds. They may derive their power, some from steam engines and boilers, others from gas engines, and, again, others from oil engines, or even from motors and secondary batteries. So long, however, as they are all connected to the common bus-bars, each of the several units will supply its quota of power to the demand upon such bus-bars.

To carry this analogy a little further, let it be assumed that the successful paralleling of alternators had hitherto never been achieved, and that every generator in this country was directly connected to a group of consumers whose maximum demand at any time was equivalent to the full-load capacity of the generator. Even though the efficiency of such individual units was the maximum attainable, it is obvious that the inability to take advantage of the improved plant factor, the increased-diversity factor, and other economies accruing from parallel running and bulk supply, would result in a combined fuel consumption at least 100 per cent. greater than under existing conditions. Let it also be assumed that the individual unit supply service described is suddenly called upon to meet the competition of a bulk-supply undertaking able to run its generators in parallel. It will be evident that notwithstanding the established connections or goodwill of the individual supply units, the bulk-supply plant will be working under such advantageous conditions that it will rapidly capture all of the demand.

The above analogy represents the conditions under which many British manufacturers, with their individual producing units, were working prior to the war, in competition with the co-ordinated or paralleled producing units of the United States and of Germany. The distributing networks of these foreign bulk-supply undertakings were being extended rapidly in every direction, but especially in British Overseas Dominions.

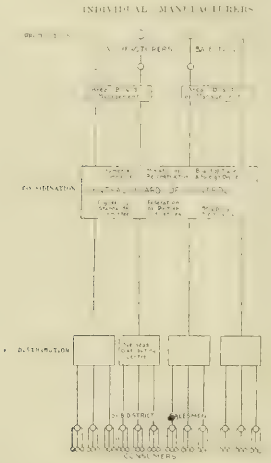
Those who favour State organisation of distribution can point to an excellent example of successful indirect State co-ordination of industry in the Government Postal Service (service, not control). Here is no despotic dictatorship—no rules and regulations to control commerce, no interference with individual effort, and yet has there ever been a more potent influence upon the conduct of industry?

If some system of overseas trade service were inaugurated and run by the State, or by State and private enterprise combined, on the same general lines as the postal service, it should be a great boon to all industries. A service of this nature is by no means so impracticable as may at first sight appear.

It must, however, be essentially a public service, and not a trading concern, its first aim being to afford British subjects in all parts of the world facilities for procuring British-made engineering products on satisfactory terms, and its second aim to furnish British producers with the fullest possible information respecting overseas requirements.

Notwithstanding all that has been done in the past to maintain and improve British overseas trade, there is abundant evidence that the results achieved fall very short of possible attainment. For instance, a large amount of machinery and engineering appliances of all descriptions is imported into Canada every year, but it is estimated that less than 5 per cent. of these imports are manufactured in the United Kingdom.

The author's opinion is that maximum efficiency will only be attained by grouping the various elements, upon which successful overseas trade is dependent, under three self-contained, closely allied, and inter-connected sections which may be classified respectively as:—(*a*) Production, (*b*) co-ordination, (*c*) distribution; the suggested co-relation and constitution of these respective sections being shown below.



Production.—The sole aim of those responsible for production should be to manufacture appliances to meet the ascertained requirements of overseas markets (f.o.r. their own works) at minimum prices consistent with reasonable manufacturing profits and a liberal scale of wages to employés. In order that producers may be free to concentrate their entire efforts upon improving the efficiency of production, it should not be necessary for them to devote their attentions to the many intricate problems associated with overseas trade. At the same time, they should be entirely untrammelled by any unnecessary restrictions in the management of their respective businesses in which they, and they alone, are experts.

Co-ordination.—There are at the present time so many organisations devoting their attention to the problems of co-ordinating and reconstructing industry—particularly the engineering trades—that it is difficult to follow and keep in touch with the various projects which are being formulated.

Co-ordination may be defined as the most efficient utilisation of all existing and potential factors of production and distribution. To ensure this, it is suggested that each of the several State and private enterprise organisations at present attacking the problems of overseas trade development from different aspects should be represented by one of its members on a central board of service, which board should be the recognised centre for all matters relating to overseas engineering trade. The primary object of this board should be:—

(*a*) To provide for adequate representation of all British engineering manufacturers in every overseas market, for which purpose city shipping merchants having established overseas branches should be utilised where possible, and distributing centres under the direct control of the central board should be organised in those overseas territories where no existing channels for British trade exist.

(*b*) To ensure that every engineering manufacturer in this country shall have an equal opportunity of competing for overseas trade, for which purpose area boards of management—such as have been employed by the Ministry of Munitions for procuring the maximum and economic production of war material—might be utilised as a decentralised purchasing agency for the large variety of engineering requirements for overseas trade.

Very complete information respecting the productive capacity of engineering works throughout the country is already in the possession of the several "Munitions Area Boards of Management" created by the Ministry of Munitions for the purpose of procuring the maximum output of war material. This decentralised system of purchasing engineering products, which has proved to be such a satisfactory method of procuring munitions on an economic basis, should be even more beneficial for the purchase of the large variety of engineering requirements for overseas trade.

Distribution.—To provide for anything approaching efficient distribution of engineering appliances, it is necessary that in every overseas industrial centre a complete distributing organisation shall be established consisting of a business general manager, an engineering staff, a number of sub-district salesmen (preferably local men well-known to every potential buyer in the particular sub-district allotted to them), an accountancy and credit department, adequate clerical assistance, warehouse and showroom or exhibition accommodation, &c.

The managers of the respective distributing centres should be men possessing tact, initiative, judgment, and resource, as well as a wide field of general knowledge. They must be given absolute authority to enter into and execute all contracts without reference to headquarters, though they should report to the central board all transactions completed each week.

The engineering staff should consist of men who have been trained in engineering works in this country, and who are consequently familiar with British workshop practice and British standards. They would advise local buyers as to the type of British-made plant best suited to their individual requirements, and would carry out contracts for the erection of complete installations where required to do so.

The sub-district salesmen (or local travellers) would be allotted separate areas to work, of such a size as to enable them to keep in touch with all buyers of engineering appliances in their respective areas. Unlike manufacturers' salesmen, who are rightly expected under all circumstances to push the sale of their own principals' products only, distribution salesmen would be required to report to the local district office all prospects for engineering work of any description. Their sole aim would be to procure the maximum possible turnover in British-made appliances without favouring the products of any individual firm.

A good and trustworthy credit department is an absolutely essential adjunct to every overseas distributing centre. The usual terms of payment in, say, Canada, are 60 days after delivery at purchasers' works, or, alternatively, part payment on delivery and the balance in instalments, frequently extended over very long periods. The local banks invariably discount purchasers' promissory notes, and make collections through their various branches when due. The principal safeguard against bad debts is an efficient credit department. Every wholesale distributor submits all important orders, before executing them, to his credit manager, who either knows or has means of ascertaining what is the financial position of every buyer, or prospective buyer, in the territory.

Any attempt to give or control credit from this side is bound to lead to heavy losses through bad debts, or, alternatively, to the loss of a large amount of profitable business.

The pricing and estimating department is possibly the most indispensable section of an overseas distributing centre. Numerous inquiries by mail and telephone, all calling for immediate attention, are received daily, and the conditions to be met are so varied that it is seldom an estimate prepared for one scheme can be used without modification for another inquiry. British manufacturers are frequently recommended to price their catalogues in the currency of the country in which they wish to do business. For engineering work this would usually be of very little, if any, value, since the cost of a plant f.o.b. English port is of no interest to the average overseas purchaser, who invariably requires the cost erected on site—say, 2,000 miles from the coast, and possibly some miles from the nearest railway siding—which cost will amount to from 150 per cent. to 300 per cent., or more, of the f.o.b. cost. Moreover, inquiries invariably call for composite tenders covering appliances made by a number of different firms. Thus a quotation for, say, a pump would usually not be considered unless it also included a petrol engine, suction-gas plant, electric motor, or other means of driving it, with switchgear, sundry pipe work, valves, tanks, &c. Performance specifications and detailed operating costs are also required with each tender.

As very few people in this country appear to have any idea of the cost of running an overseas distributing centre (manufacturers frequently suggest 5 per cent. as an adequate selling commission), the particulars of a year's costs, shown in Table I, actually incurred in one of the industrial centres of Canada, may be of general interest.

Table I.

Rent, rates, taxes, and insurances	£1,205
Salaries, management, engineering, and clerical ...	2,482
Salaries, salesmen, and travelling expenses ...	1,793
Packing and delivery charges	764
Office supplies, advertising, legal, and general expenses	572
Bank charges, interest, discount, and exchange ...	310
Postage, telephone, and telegrams	241
Depreciation and bad debts	396
	£7,763

Total turnover during period covered by above operating costs = £30,013.

Ratio of operating costs to turnover, 25.8 per cent.

Gross profit, £7,012 = 22.4 per cent. of turnover.

An analysis of the above charges appears to show that slightly more than half of the total expenditure is incurred on charges unaffected by turnover, but controlled mainly by the size of the area to be worked, whereas the remaining expenses are approximately proportional to the turnover.

The distributing area in which the results shown in Table I were obtained is known as the Middle West or Prairie Province of Canada. It is bounded on the east by the Great Lakes, and on the west by the Rocky Mountains, the chief centre of distribution being the city of Winnipeg. Some particulars of the developed portion of this area, given in Table II, will show how impossible it is to work such a district efficiently without incurring heavy operating expenses.

Table II.

Extreme length of district, E. and W. .	1,300 miles.
Extreme width of district, N. and S. ...	300 miles.
Approximate area	160,000 sq. miles.
Total mileage of railways	10,000 miles.
Towns having a population of over 500 ...	150
Aggregate population of above towns ...	770,000
Average population per town	5,000
Number of rural post offices	3,400

The rural post offices are chiefly mail-distributing centres for farmers, who, it must be remembered, are all potential buyers of engineering appliances, including agricultural machinery, motor cars, pumping plants, heating and lighting installations, &c.

Finance.—In endeavouring to compute what capital or financial backing would be required to carry out the overseas engineering trade service proposed, one encounters the difficulty that the engineering industry covers anything from, say, the supply of the smallest electric motor to the equipment of a bulk-supply power scheme or the building of a railway. Whilst the organisation, through its overseas distributing staff, would find many opportunities of rendering valuable assistance in connection with heavy engineering schemes, its principal source of revenue would probably be the profits on trading in general engineering merchandise of a kind that would be handled by shipping merchants.

Reference has been made to the desirability of procuring the collaboration of shipping merchants in all markets where such merchants have established distributing branches. The co-operative purchasing, and other features of the proposed central control scheme should greatly increase the previous profits and turnover of these established businesses—on the other hand, their experience, local knowledge, and trade connection should be invaluable to the central organisation. It is suggested that as an inducement to such firms to merge a portion of their increased profits in the co-operative scheme, they should be guaranteed an annual net profit equivalent to the average net profit during the three years prior to the war, and that they should retain in addition one-third of the extra profit earned each year as the result of the larger turnover, and other benefits accruing from their amalgamation with the central organisation. The remaining two-thirds of the excess profits would be applied towards meeting the expenses of the central control board.

Discussion.

Mr. Percy Griffiths, opening the discussion, congratulated both the author and the Institution on bringing this matter forward at this particular moment; our military operations were a secondary matter—our position depended upon our supremacy at sea, which was bound up with our oversea commerce. Our commercial position was of vital importance; if the war ended and found us unprepared to improve our position, we should have failed. The more efficiently we could deal with these subjects the better for us, and he specially congratulated the Institution on being the first to bring this particular subject to the front. The initiative must lie with the trade, and must not be handed over to the Government; this was an *essential* factor—any attempt to vary it would be fatal. The word "control" appeared repeatedly in the paper; he preferred "service," as any such organisation must be for the service, not the control, of the industry, and any trader would resent "control." A better expression would be "federation of trade interests." He did not agree with the author's references to the economic results of the absence of competition between manufacturers under the present system; the munitions system had been very unsatisfactory from the economic point of view, and the nation's money had been squandered. It was the only possible method to meet the emergency, but was not suitable for trade development. The financial control must be in the hands of the trade; if the Government exercised control, it must contribute to the cost in proportion to the control, but both these points should be left out of the question. He suggested that the author's scheme as a whole was complex and unwieldy; there was a gulf between individual manufacturers and consumers that would make for trouble and hinder trade. Such a scheme might be most effective in new countries, but more direct communication must be provided between maker and user. In the first instance, sales must be by catalogue, but in large work there must be direct communication. In the past manufacturers' standards had been forced upon consumers; they must be more elastic in meeting local conditions in the future, especially in foreign and new countries. Sub-district salesmen must be engineering experts—it was very important that the user should have direct access to an expert engineer.

Mr. W. L. Madgen agreed in the main with Mr. Griffiths. The alleged unwillingness of the British manufacturer to vary his standards was an argument that was popular with the halfpenny papers some years ago, when they were slating English makers, but a population of 45 millions could not make everything. Their efficiency would be improved by selecting suitable standards and pushing them vigorously. He was struck by the section marked "co-ordination" in the author's diagram; he doubted the efficiency of the composite body outlined. Such a body would become a machine to provide salaries for officials. As a large buyer of machinery, he endorsed Mr. Griffiths's remarks about expert salesmen; the buyer wanted *help* in deciding what to install.

Mr. Ll. B. Atkinson congratulated the author and the Institution on raising a subject so interesting and important —much more so than any technical matter. Mr. Andrews advocated the abandonment of individual methods; we *must* do this, or fail. He showed a slide illustrating the enormous ramifications of the A.E.G., and said that manufacturers could not cope single-handed with this huge organisation. A similar organisation existed in the United States, with immense possibilities; in the past its operations had not extended abroad, but they would do so in future. They were up against these huge combinations, and would waste their time and trouble if they did not co-ordinate their efforts. Whether the author's scheme was best or not was open to discussion, but the mention of Government control would kill it. Yet individual British engineers were reluctant to co-operate. They must be convinced that by doing so they would get more work than otherwise.

Mr. Newlands described the course of events at the opening of the war, and the formation of Area Boards of Management, leading to large production. Co-ordination was, in his opinion, the key to success, of which he was assured.

Mr. Percy Rosling differed from the author's diagnosis and from his proposed remedy. He said that if they compared like with like, the British salesman had little to learn from his foreign competitor. But *small* manufacturers must combine, and appoint their own joint representatives, as the large British firms had done. The A.E.G. had British salesmen in Australia, and so had the Americans; British staffs were preferred. If the British would refrain from helping the Germans in future, the Germans would be blown out of our Colonies. In such countries as China and S. America cheapness was the criterion. The success of the large German concerns was due to the fact that the buyer could fill his requirements from branch offices on the spot in most parts of the world, and repairs and spares were obtainable cheaply and quickly from these branch houses everywhere; there was no difficulty or delay in dealing directly with headquarters. The key to the situation was to hold our own market first, then British workmen and manufacturers could beat any country.

Mr. Selwyn Grant said that the Area Boards of Management were created by the Ministry of Munitions when their work could not be accomplished by any other means; they were enormously successful, but with widened spheres of activity difficulties cropped up. The fundamental difficulty was to distribute expert knowledge; there were too many links between the producer and the purchaser.

Mr. J. E. Kingsbury said that in considering this matter they must bear in mind what had happened in the past. The point requiring the greatest attention was the middleman. The board of control should be divided into two sections, information-getting and work-getting. It appeared to be somewhat cumbersome, perhaps due to the analogies of the Ministry of Munitions and the Post Office. The Ministry of Munitions was a despotic power, formed for one purpose, and to supply one customer only. The Post Office was also despotic, and both were monopolies. If a middle-man were introduced he would create a monopoly, but the overseas trade of the future must not, and would not, be a monopoly, and it could therefore not be managed by a Government institution.

Mr. F. Broadbent missed from the central board of control any reference to shipping and railway companies, whose co-operation was essential to success. In Germany special railway rates were quoted for export goods, whilst special export rates were given here only where the railways were in direct competition with shipping. Conference rates existed between German and English shipping companies, yet a German concern could quote lower through rates to our Colonies than any English manufacturer. He gave instances showing how British manufacturers could save by shipping *viâ* Antwerp. Preference was given to foreigners by our shipping companies; even on the *same ships*, and for shorter distances, there was 50 per cent. difference.

Mr. E. T. Williams said that it was absolutely necessary for this country to develop a tremendous output of exports. At home people did not realise the immense openings for trade abroad. After the war, "business as usual" would not serve; steps must be taken on organised and rational lines for collective action. A previous speaker had put the matter in a nutshell: "Help the trader to expert assistance, without interference with individual action." He was in full sympathy with Mr. Andrews, though not necessarily in agreement with his proposed methods. They must get ready in time, and take action ere it was too late.

Mr. E. W. Cowan reminded them that someone had said the cessation of hostilities would find us as much unprepared for peace as the outbreak of war had found us unprepared for war. We must prepare beforehand, and try to realise the conditions of the future peace. As a matter of principle, as a manufacturer, he did not like the separation of production from distribution; it was best to run the business as a single machine, under the control of one mind. According to his experience, the adaptation of the views of the maker and the user could not be carried out on the lines of the author's diagram; there should be a short circuit between producer and consumer. He had been engaged in commerce with new countries, and adopted the plan of sending bulletins round to the plantations, receiving inquiries, and communicating with the manufacturer; he could not conceive of a better system.

Mr. A. H. Foyster said that purchasers were willing to buy British goods, but were driven again and again into the hands of Americans and Germans; there were many channels of information in existence, but they were not co-ordinated. The shipping merchant did not want a technical man on his staff, as this would add to his responsibility; his business was merely to buy goods and ship them as ordered. There were many difficulties and delays in the way of the purchaser in getting the stuff from home; he must go through a firm actually represented in the colony.

Capt. R. B. Slacke said that some organisation was necessary to deal with farmers, whose finance depended upon the prospect of a good harvest at some future date—no manufacturer could finance that position. The huge German organisation did not feel the financial burden, and some means must be found to remove this handicap. Could not the Councils of the Institutions of Electrical, Civil, and Mechanical Engineers combine and recommend to the Overseas Trade Advisory Committee a plan to co-ordinate the interests involved? It was of no use to discuss the details of the scheme there; they should do something to get into touch with the Committee or the Government somehow.

Mr. Harry Allcock cordially endorsed Mr. Atkinson's remarks, and said that the author had shown that the profitable expansion of our engineering trade was intimately connected with our future safety. Production was assured—our works were already enlarged; the first question that would arise after the war was "oversea distribution." Individual representation was useless; he had heard of 18 representatives in the same trade competing in one locality. The appointment of a local firm of merchants fortified with technical assistance was not favoured by manufacturers, because the merchant house got all the credit. Groups of allied non-competing manufacturers formed to share expense in particular markets were liable to break down from internal stresses. The solution that he preferred was that an association of manufacturers in a given trade should select their own representative and send him out to sell "British" goods against American or German firms. The orders would go to a central sales bureau, and thence be distributed to the allied firms. He emphatically disapproved of any State share in the organisation; the State should do all that it could to facilitate commerce, by providing direct cable communication, adopting decimal coinage and the metric system, and in other ways.

Mr. H. W. Bosworth said that the fatal objection to State control was that it was not compelled to make a profit, and was certain to result in inefficiency and endless forms to fill up. For an oversea representative to obtain orders to be allotted on competitive lines would suit neither purchaser nor manufacturer. The purchaser would not deal with a nameless firm, and the manufacturer would not care to lend his catalogues, &c., to the organisation—he would send out a representative to short-circuit the scheme. There were in this country no fewer than 45 firms making motors up to 5 H.P., and 25 making larger machines; if each firm were to specialise in a definite range of sizes, or a particular article, the results would be amazing. Five or six firms, each making one thing, could combine to secure representation abroad on an adequate scale; a series of groups of manufacturing firms would be formed in England, and these groups could co-operate with one another. Developments had already started on such lines.

Mr. R. J. Kaula did not favour so bureaucratic a scheme as the author had put forward. The markets might be subdivided between firms in similar lines. Our manufacturers were apt to overlook the necessity of finishing machinery in the *smallest details*; neglect of this caused endless trouble in distant countries, where materials and tools were unobtainable. Suitable men must be secured as foreign representatives—they must be more expert than the average branch manager at home; this was a factor of great weight in securing orders. Many men fresh from college sought positions in selling organisations because the salaries paid on the technical side were so low; if a living could be made in these lines, plenty of men would be available from the technical side to draw upon to send out with complete confidence to compete with the Germans.

In reply, Mr. Andrews claimed that most of the criticism was addressed to the details of the scheme; most of the speakers endorsed his point that *co-ordination was essential.* He would deal with the discussion in the *Journal.*

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

5,953. "Elbows, &c., for electric conduits." J. Wilkie. April 8th.

5,966. "Electric switches." W. J. Howard and Reyrolle & Co. April 8th.

5,970. "Starting switches for alternating electric current motors." W. P. Hamlyn & British Thomson-Houston Co. April 8th.

5,971. "Incandescent cathode devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 8th.

5,982. "Ignition magnetos for internal-combustion engines." E. Marelli and Co. April 8th. (Italy, April 6th, 1917.)

5,986. "Brushes for dynamo-electric machines, &c." H. J. Hinley. April 8th.

5,992. "Electromagnets having movable cores or armatures." E. C. Villiers. April 8th.

5,993. "Means for adjusting and indicating travel of machines or instruments operated by core or armature of electromagnet." E. C. Villiers. April 8th.

6,001. "Gas and electric cooking stoves, &c." C. J. Humpherson. April 9th.

6,007. "Electric cut-out." W. H. Illingworth. April 9th.

6,021. "Electro-massaging apparatus." H. Ashton. April 9th.

6,029. "Sparking plugs." Clerget Blin et Cie & P. Clerget. April 9th. (France, January 19th, 1917.)

6,038. "System of electromechanical illuminated recording winding-engine signals in coal mines." J. G. Dickson & T. A. Jones. April 9th.

6,039. "Electric furnaces." J. A. Fleming. April 9th.

6,055. "Bases for incandescent electric lamps." H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. April 9th.

6,059. "Primary batteries." E. Sokal & S. Sokal. April 9th.

6,068. "Insulators for supporting electric cables." Soc. Metallurgica Italiana & H. Wade. April 9th.

6,087. "Incandescent electric lamps." J. F. Bennett, W. M. Gillott and G. S. Marple. April 10th.

6,090. "Automatic cut-outs." A. Fernandez. April 10th.

6,101. "Electrolytic treatment of ores." B. Hunt. April 10th.

6,104. "Controlling alternating-current power stations." E. P. Hollis. April 10th.

6,110. "Magneto." Sir G. Smith. April 10th.

6,131. "Process for generation of electrical energy." C. Benitez. April 10th.

6,138. "Electric switches." M. Brooks, W. Compton, J. E. Franks, A. E. Read & Walsall Hardware Manufacturing Co. April 11th.

6,146. "Electric signalling systems." H. Green. April 11th.

6,180. "Insulating materials." British Thomson-Houston Co. (General Electric Co, U.S.A.) April 11th.

6,196. "Transformation of electrical energy." C. O. J. Montelius. April 11th. (Sweden, March 24th, 1917.)

6,215. "Telephone receivers." E M. C. Tagerstedt. April 11th. (Denmark, March 31st, 1917.)

6,222. "Means for indicating in connection with electric circuits." J. Roberts. April 12th.

6,243. "Driving couplings for magneto-electric machines." C. E. Hulse and M-L Magneto Syndicate. April 12th.

6,247. "Electric pocket lamp with mechanical electric generator." A. Luzy. April 12th. (France, October 15th, 1917.)

6,255. "Photo-electric aircraft revealer." A. Orling. April 12th.

6,256. "Liquid resistances." Brush Electrical Engineering Co. April 12th.

6,257. "Electric welding apparatus." Thomson Spot Welder Co. April 12th. (U.S.A., October 8th, 1917.)

6,260. "Electric signalling apparatus." N. Turner. April 12th.

6,272. "Electric car-lighting, &c." A. Contet. April 12th. (France, May 18th, 1917.)

6,273. "Electric lighting apparatus." Benjamin Electric, Ltd. April 12th. (U.S.A., April 19th, 1917.)

6,298. "Machines for cutting bulbs of electric incandescent lamps, &c." R. S. Brownlow. April 13th.

6,307. "Electric generators and motors." L. Collette. April 13th.

6,310. "Telegraph systems." F. J. Mackenzie. April 13th.

PUBLISHED SPECIFICATIONS.

1916.

18,411. Electrodes for Searchlights. E. A. Sperry. December 22nd, 1915. (102,971.)

1917.

2,741. Electrostatic Generators. D. K. Morris. February 24th, 1917. (114,174.)

3,798. Driving Mechanism for Magnetos. Soc. Larraine des Anciens Etablissements de Dietrich et Cie de Luneville. April 3rd, 1916. (106,471.)

3,865. Electric Selectors. G. A. Betulander. March 17th, 1916. (105,332.)

4,162. Electric Cables, Flexible Conductors, and the like. J. H. Ward and H. Goldstone. March 22nd, 1917. (114,197.)

4,948. Electric Pocket Lamps. S. Biheller. April 5th, 1917. (114,215.)

5,481. Sparking Plugs for Internal-combustion Engines. F. J. Turquand. April 19th, 1917. (114,224.)

9,383. Electric Motor Control. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 29th, 1917. (114,246.)

9,919. Supports for Electric Cables. J. F. Watson and Callender's Cable & Construction Co. July 10th, 1917. (114,249.)

11,034. Power-operated Electric Switches. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) July 31st, 1917. (114,098.)

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13,141. Incandescent Electric Lamps. J. Bilefield. September 13th, 1917. (114,266.)

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THE REPORT ON POST-WAR TRADE.

THE Balfour Reports on Post-War Trade Policy, which are abstracted on another page of this issue, contain a number of interesting conclusions and recommendations. It is admitted that in certain branches of British manufacturing industry German control was becoming a serious matter when the declaration of war brought penetration plans to an end. During nearly four years that have elapsed since then the nation has learned many things concerning the growing enemy predominance which would probably have been described as incredible and untrue in the times of peace, when it was less easy to drag commercial penetration designs out before the public gaze in all their nakedness. Though our war aims are not to crush the German people, but to defeat for ever the monstrous influence which has misguided them, and brought them alienation from all the free peoples of the world, it will assuredly be the determination of Britain and her Allies that that policy of unscrupulous commercial domination shall never again be permitted. By what means are we going to prevent deplorable history from repeating itself? The Committee finds that the war conditions, for which we have to thank the enemy, have assisted us to a great extent by creating the necessity and the opportunity for strengthening places which had become weak in our industrial armour. But measures must be adopted to ensure that the experience gained, and the progress made, by us in so many directions during the war, shall not be thrown away when new relations are established between us and our present enemies, however chastened and democratised the latter may be when the end shall come. Whatever those measures may be we shall all agree with the Committee that they will be of little avail unless employers and employed can be brought to see the absolute demand of the situation for a united effort of all to attain the largest possible volume of production with maximum efficiency. We cannot be fully equal to the financial and economic strain within reasonable time unless as a nation we fully recognise and implicity obey that demand. The policy recommended by the Committee, of prohibiting the importation of goods of enemy origin, is already embodied in legislation which was passed some months ago. The Committee made the recommendation "subject to licence in exceptional cases." In addition, we and our Allies should adopt a policy of joint control of the export of certain important materials which will be required for the restoration of our industries, and the proposal that a joint organisation should be set up for dealing with Allied orders for reconstruction purposes seems to be a thoroughly sound one. In the conviction that State restrictions on industry should be removed at the earliest possible moment after peace, the Committee is in accord with the mind of business men who know too well the deadening effect of "control" upon initiative and enterprise. The Committee favours a "selective" rather than an exclusively "Empire" policy in respect of raw material resources, but the main purpose of such selection is one of the things upon which all are in agreement, namely, that we may ensure that the Empire in an emergency shall be independent, for its supply of any essential commodity, of any single foreign country or possible combination of countries. Of course, we must safeguard and foster essential industries—there is not a dissentient voice to that proposition to-day. If there were it would be that of little less than a traitor or some poor fool who had forgotten all the risks that we ran during the early stages of the war through our former dependence upon enemy supplies of certain manufactures. If Lord Balfour's Committee's advice is adopted we shall rigorously exclude aliens from certain occupations—such as pilot and patent agent—we shall license foreign commercial travellers, watch the ownership of companies, and stringently "police" subjects of present enemy countries after the war.

We quoted in our last issue the Committee's recommendations respecting trade organisation, and closer combination among traders as a means of meeting increasing foreign competition, and those who have followed our statements on this subject will know how heartily we are in accord with the proposition that individualism must be supplemented by co-operation. "Every encouragement should be given by the Government to the formation of combinations of manufacturers and others concerned with securing supplies and materials," but in regard to production, "the constructive action must come from the industries themselves." The Committee considers it as a general rule undesirable that the State should attempt to provide capital for industrial purposes, and we believe that industry will find it more satisfactory to rely upon its own efforts and the efforts of private banking enterprise and the Trade Bank Corporation, than to look to the State, which would inevitably, it seems to us, have to impose such a measure and character of control as would not be welcomed. Nobody can tell at this stage of the war what the economic conditions dictated by the terms of Peace may be, throughout the world; we have also nothing to guide us as to what will emerge from the next General Election, with its vastly increased and altered body of voters; but we commend the statement of the Committee on fiscal policy to our readers' careful attention. The hour has not yet struck for the profitable discussion of this great subject, but sooner or later it will come prominently before the nation, which, under the influence of war and war-time revelations, has developed some of its thinking. That pivotal industries must be maintained "at all hazards and at any expense"; that there must be safeguards for our producers against "dumping" and "sweated" imports, and preferential arrangements between ourselves and the Overseas Dominions and Possessions; and that everything possible should be done to promote trading relations between ourselves and our Allies and neutral countries—these, we feel, must be regarded by that part of the nation that really thinks about such matters, as perfectly sound proposals. It is suggested that an independent State Assistance Board should be set up to advise the Government upon claims for protective assistance for different industries and to frame proposals. There is little room for doubt that some such Board will be needed.

The Metric System.

In our "Notes" last week we gave extracts from the reports of Departmental Committees appointed to consider after-war trade, which show that the authors are opposed to the adoption of the metric system, and that their views are based on contradictory and largely erroneous impressions. Thus the Engineering Trades Committee states that manufacturers already use the metric system "without difficulty for their own convenience," while the Shipping Committee understands that all existing patterns, dies, jigs, gauges, &c., would become useless—a wholly mistaken idea. The former Committee says "there is no demand from the side of the manufacturer" for the adoption of the metric system; the latter states that a number of witnesses, as well as the majority of the firms replying to inquiries, expressed themselves in favour of the compulsory adoption of the metric system. The Shipping Committee, however, deliberately throws overboard this consensus of opinion, and gratuitously casts doubt on the mental capacity of the firms referred to. We are told that "in book-keeping and in the payment of wages, calculating machines now in use reduce the inconvenience of our monetary system, if any, to a minimum"; that "*if any*" is delicious—but what of the cost of these machines, and the number required, as compared with the cost and number of purely decimal machines to do the same work in a rational system of units? The decimal machines would be able to deal with metric weights and measures as well as money.

Again, the Engineering Committee advocates the abandonment of binary divisions of the inch in favour of the division into hundredths (*sic*—we thought it was thousandths) "which is already used exclusively for high-class work," while the Shipping Committee says that "in the works, feet, inches, and subdivisions of inches, *i.e.*, halves, quarters, eighths, sixteenths, thirty-seconds, are used without inconvenience." Further, the latter Committee goes out of its way, showing the clearest prejudice, to demur to the decimal subdivision of time and of the right angle, which are not proposed by anybody.

Even the Textile Trades Committee "found among individual witnesses a decided predisposition in favour of the metric system," but reports against it. Here again is the usual contradiction:—The Committee dwells on the confusion and inconvenience that would be caused by a change from the yard to the metre (*i.e.*, practically 10 per cent.), and goes on to say that, in point of fact, both exporters and manufacturers when trading with metric countries *do* quote and deliver goods in metric weights and measures, adding that a universal system of weights and measures would be a source of great convenience, and would facilitate international trade! Let us be thankful that this sapient and logical-minded Committee at least recommends the simplification of our units and the decimalisation of our money.

Turning to a still more important report—that of Lord Balfour's Committee—we observe, with great regret, that the majority of the signatories reject the proposal to adopt the metric system, giving reasons very similar to those mentioned above. For example, they advance as an objection the fact that "before the war more than half our export trade was with countries which do not use the metric system"; they fail to realise that this was the case in great part *because* WE *do not use it*—our trade ought not to have been so restricted. The same arguments as to the heavy cost of altering machines are put forward—but why should they be altered? An argument of the anti-metrists is cited in par. 285, that "for practical purposes binary divisions are better than decimal," but in par. 288 the Committee throws this overboard, stating that "we would also emphasise the advantages, already widely recognised, of using decimal subdivisions of our basic units"! Thus our opponents flounder in the mud of prejudice, catching at straws to save themselves from submersion, and were space available we could go on exposing their futilities. Their *non possumus* extends also to decimal coinage; we are pleased to note that they agree with us as to the necessity of retaining the pound sterling as the essential unit of value, and as to the convenience of decimal coinage, but they boggle at the slight change (4 per cent.) in the "value" of the penny—this at a time when the penny is worth about as much as a pre-war halfpenny, and penny postage is being abolished! We hope that Parliament will adopt a saner view of the situation.

TUBULAR EARTHS FOR LIGHTNING CONDUCTORS.

By KILLINGWORTH HEDGES.

There are several objections to the use of the plate form of earths. Although they may have been buried to a suitable depth in moist ground, their efficiency decreases as the soil dries away; the plate is then only in partial contact, and the resistance increases sometimes to such an extent as to insulate the ground connection.

A lightning-conductor installation is usually left to take care of itself. Theoretically, it should remain efficient for the life of the building; but, at any rate, it should be reliable for many years, so that it is very necessary to furnish it with a permanent ground connection having an unvaried resistance.

The entire system of protection may be rendered useless by a poor connection. The discharge must get to the ground water, or at least to wet soil. Dry earth is such a bad conductor that a case is mentioned in the *Bulletin* of the University of Missouri of a lightning stroke that was known to travel 900 ft. from the house that was struck, along a water pipe buried in dry soil, and damage a drinking fountain where the current was earthed.

The tubular earth, with its point driven firmly into the ground, does not lose efficiency by changes in the soil which are noticeable in the proximity of new buildings, due to drainage, and it has a constant resistance. Another important factor is its lower first cost, which, at the present time, is specially noticeable owing to the high price of copper and cost of labour for excavating the space for the plate earth.

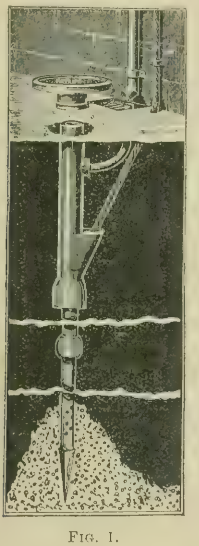
Fig. 1.

Although pipes filled with water, with conductors attached and inserted, have from time to time been used for telegraph ground wires, it was in connection with the protection of St. Paul's Cathedral against lightning that the now well-known driven-tube plan was first installed by the writer, the early patterns being made up of built-up steam pipe, the conductor entering at the top. This method was discarded, as, after about five years, the tube was found to have badly deteriorated near the surface of the ground. The standard pattern, as shown by fig. 1, was then designed, using a cast-iron top piece, which is connected to the tube by set-screws (not shown in fig. 1). A leaden washer may be inserted between the tube and the cast-iron socket, to perfect the joint, and the tubes are driven with a sledge-hammer by means of the driving piece, fig. 2, which is screwed into a socket, taking care that it actually butts on the top of the tube.

A very large number of this pattern have been driven in all sorts of ground, including hard chalk, and have been specified for Admiralty contracts to be sunk to a depth of over 20 ft. In the writer's opinion, it is unnecessary to have a low resistance, if sufficient numbers of earth connections are installed. If moist earth is not reached at a convenient depth, the system of watering should be applied, either as shown in fig. 1, or by collecting surface moisture, as shown in fig. 3; a constant resistance of under 5 ohms is obtainable by watering, even in dry ground. A recent test of a large number of tubular earths, sunk by Messrs. W. T. Furse, of Nottingham, averaged 1 ohm each immediately after driving. This low resistance is good, but, as stated, not really important. In another system of earths, it has been obtained artificially, by partly filling the tubes with rock salt; this has the objection of introducing a substance which in time will have a deleterious action on the connection to the tape or cable. Some of the tubular earths at Westminster Abbey were tested six years after they were installed, and their conductivity had improved; this was probably due to the granulated carbon which surrounds the conductor being packed tightly against the inside of the tube by the action of the water which trickles through.

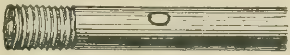
Fig. 2.

A new method of making the joints between the conductor and the cast-iron top piece is by using lead yarn. This method enables the joint to be made quicker than with molten lead, and does away with the plumber's "devil" and possible danger of fire. In order that the tape can be easily dropped to the bottom of the tube after the required depth for the earth has been reached, there is a free way through the socket. This space is afterwards closed by the loose washer A, fig. 3, which fits into the socket, and lead yarn is tamped round the conductor a skein at a time, until the whole mass is solid. To guard against corrosion where the tape enters the socket, a space is left, which is filled with insulating material; and, to obviate surface leakage when used for earthing at electric light and power stations, an outer casing is fitted, and also filled up with compound. Fig. 3 also illustrates a new form of tubular earth (patented) which does not require a watering pipe. A funnel-shaped cast-iron top, fitted with a removable strainer, is sunk level with the ground, and collects the rainwater. The lower tube is not perforated, but has a loose point, which engages by means of two lugs with the tube when this is being sunk, and is afterwards driven further into

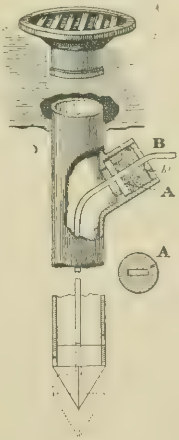

Fig. 3

the earth by means of a rod inserted into the tube so as to form a space (as shown by the dotted lines) into which the conductor is dropped and surrounded with carbon in the same manner as in fig. 1. The detachable point method is recommended for use in ordinary ground, and for depths not exceeding 10 to 12 ft. For hard ground, such as gravel, sand, or chalk, or with numerous stones, fig. 1, which has a hardened steel point, should be used.

The problem to be considered in protecting a building from lightning is, first, to provide many points ; this is very often facilitated by the existing metal work of the roof, as these projections also take the upward discharge and lessen the violence of a flash ; secondly, there should be as many earth connections as possible ; with tubular earths, small tubes, two or more in parallel, are preferable to those of larger surface area.

It is thought that the new method of utilising lead yarn for the purpose of electrical connections would be found a quick substitute in emergency work for the usual clamp. The patentee would be pleased to give facilities to electricians who wish to experiment with the material.

LARGE BATTERIES FOR POWER PURPOSES.

By E. C. McKINNON, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The apparently large batteries of 20 years ago were small compared with some of those installed in recent years. Really large batteries are still uncommon in this country, but there are sufficient to enable one to study the design, management, working conditions, and results obtained, and to appreciate that batteries can be successfully designed and built for almost unlimited capacity.

Large batteries have been developed in this country mainly as a result of healthy competition between British battery companies. More progress would have been made but for many obstructing factors, such as: (*a*) Irreconcilable prejudice against batteries, (*b*) difficulty in providing the necessary capital, (*c*) attitude adopted by Government Departments, (*d*) reluctance to allocate adequate space to batteries, (*e*) inadequate training of engineers, (*f*) misconceptions about batteries, their functions, &c., (*g*) lack of technical supervision over battery operators, (*h*) indifferent working conditions, (*i*) want of appreciation of the possibilities obtainable with batteries, (*j*) absence of standards.

The absence of standards is a distinct deficiency, and the author advocates an investigation into the possibility of drawing up suitable standards for battery specifications, design, method of testing, and maintenance agreements.

The conditions under which the battery will be operated form a most important factor in the results obtained.

The aspect of the room is quite important, and powerful sun-rays striking direct on portions of the battery will cause irregular working.

Ventilation is certainly important, but it should be confined mainly to the removal of gases. Strong currents of air should be avoided. Wherever there is a need for forced ventilation it is preferable to draw out the air, as the incoming air can be readily cleansed and the exhaust can be passed through acid filters or separators.

There is such a wide range of opinion as to the design of battery-room floors that the author hesitates to advance any rigid recommendations in this respect.

It is difficult to make an acid-tight floor with tiles or bricks set in cement. Asphalt is an excellent acid-proof covering, but it is not suitable to bear heavy concentrated weights, especially in a warm room. The best floor which can be used is probably one of vitrified brick or tile laid on concrete, with the joints pointed with an acid-resisting, asphaltic, or bituminous compound. The compound should be of such a quality that it will not become brittle, but will remain plastic at all times. The tiles should be laid about ¼ in. apart, so as to provide proper space for pointing. In cases where the battery room is not directly on the ground the extra precaution should be taken of placing a layer of felt or paper treated with acid-resisting compound on the top of the concrete. Cement will not resist acid for long, but modern batteries do not weep acid to any appreciable extent, and a cement floor will be found thoroughly durable if periodically swilled down with water.

The slope of the floor is important, and the author advocates a gradual slope of 1 in. in 10 ft., from end to end of the room, or from each end to the centre, terminating in gutters, and no fall or slope across the room. Any supports below the lowest tier of insulators form part of the building, and not part of the battery. These supports of whatever description should terminate in a dead-level surface of uniform height. Wooden floor plates at right angles to the stillage have the advantage of distributing the weight, but are an obstruction when swilling down the battery room.

The construction of the walls is not of minor importance. Lime-washed walls are not very suitable, as the lime flakes off, and it has a neutralising effect on the acid in the cells. Mortar setting does not withstand the acid very well. A cement facing is good, especially if given a heavy coating of light-coloured paint. Vitrified bricks make a sound durable job, but better appearance is obtained from glazed bricks or tiles.

The type of ceiling or roof of a battery room is of importance. Whitewashed ceilings are even more objectionable than whitewashed walls; metal work, however high the roof and however carefully painted, deteriorates quickly. Ferro-concrete has the objectionable quality of "sweating." For appearance and durability a wooden ceiling painted or varnished has much in its favour.

A most unfortunate habit prevails of installing the battery and then setting to work to fit lamps, ventilating ducts, and supports for conductors, all of which could and should be done before the battery is assembled. If a battery is on an upper story it is better to be able to raise the goods through a hatchway in the floor. Overhead lifting tackle should therefore be provided, and in addition sufficient working space to land the goods and to carry out repairs should be allowed for in fixing the dimensions of the battery room. A sink should be fitted, and there should be a suitable water supply for cleaning out purposes. Facilities for replating and cleaning out a large battery should be considered when designing the room. Waste acid and sediment might be conducted outside the building to a convenient position for handling the acid and trapping the sediment, which has a value at least 25 per cent. that of the old battery plates per ton. Disposal of the waste acid is a problem which must be dealt with. The contention occasionally set forth that waste acid must be neutralised before passing to the drains is impracticable when dealing with large quantities. A complete water-supply system should be designed for the provision of distilled water, including the still, storage tanks, and the distribution pipes terminating in valves or taps. It is also useful to provide an effective acid pump with the necessary delivery pipes to obviate the haulage of carboys up to the battery room.

Good illumination in a battery room is required, but for inspection work a dark room with light concentrated on one cell at a time is found advantageous. Lamp fittings should be of porcelain, and should be assembled over the passages, and not directly over the rows of cells. Portable lamps are most serviceable if protected with wood or ebonite shields. The connections should be rubber covered, and wall plugs and sockets should be of porcelain.

Extremes of temperature do not occur in this country to an extent which renders it necessary to equip battery rooms with heating apparatus or cooling fans, but the effect of temperature on the capacity, efficiency, and life of a battery should not be overlooked. The objections to very high temperatures are mainly that any impurities in the battery are more active at high temperature, evaporation is excessive, the gas bubbles float in the air more readily, any acid spray dispersed concentrates more rapidly, and the strong acid attacks wood and metal work. The capacity of the battery is increased, consequently the plates can be overworked at the expense of their life. There is also a tendency for the woodwork to shrink at high temperatures. On the other hand, at low temperatures the capacity is temporarily lowered, the mean voltage on discharge is lower, and the main voltage on charge is higher. This results in a decreased efficiency. Further, if the pressure is lower on discharge, more current is required for the same number of watts. This increased current involves a discharge from the battery at a rate at which it yields a lower capacity, and to obtain even this capacity it may be necessary to run the battery down to a lower voltage.

The choice of material used as conductors may be left to the consideration of prevailing prices and local conditions. Bare copper rods for efficiency, appearance, and ease in assembling are readily first favourite with many. Bare aluminium is a strong competitor on the question of cost, but is less satisfactory in appearance and manipulation. Insulated cables are going out of use more and more wherever possible. Taped and braided cables are unsuitable. Lead-covered cables are cumbersome. India-rubber covered cables are quite satisfactory except as regards fire risks and their unwieldiness in heavy sections. If paint is employed to protect the copper or aluminium conductors in a battery room several coats should be applied, but owing to intermittent expansion and contraction there is always a tendency for the paint to crack, and concentrated acid—the residue of acid spray—will penetrate a hair's breadth crack and play havoc with the conductors. The most satisfactory form of protection is lead covering with the further protection of a coat of grease or paint, or, alternatively, a coating of vaseline on the bare copper or aluminium, occasionally wiped off and renewed.

Where possible the conductors may with advantage be supported by iron suspension rods and hangers, from which they may be insulated by split porcelain insulators designed for actually clamping the conductors in place. This is necessary because of the enormous forces which are exerted between parallel conductors carrying very heavy currents.

Large batteries usually require gangway platforms for purposes of insulation, or to bring the operator's head and shoulders above the level of the cells. An open lattice or rack pattern is satisfactory, but the author prefers a solid flooring laid on longitudinal joists, and for the purpose of cleaning the insulators and floor, the platforms should be made in closely-fitting removable sections.

Insulated earthenware pillars form an excellent alternative to wood stillage. Iron or steel girders and cast-iron standards have now rightly been abandoned as unsuitable for supporting a battery. Where wood stillage is employed it is advisable to split up the lengths into 18-ft. sections to improve insulation. It is also advisable to insert transverse gangways where the battery rooms are built very long. No rule can be laid down, but 40 ft. is found to be a convenient approximate maximum.

Although competition has led to some attempt at standardisation by battery makers, much remains to be done, and the desired object will never be achieved until the matter is taken up by representative bodies. Four main sections call for agreed-upon standards:—(*a*) Design of cells, (*b*) specifications, (*c*) tests, (*d*) maintenance agreements.

When dealing with design of cells, more especially those constituting large batteries for power purposes, the items may be divided into two categories, those open to standardisation and the variables. The items to be standardised embody plates, electrolyte, separators, and containers.

It may be accepted that all large batteries will be assembled in lead-lined wood boxes. The thickness of lead lining need not be more than 3½ lb. per sq. ft. Provided that the battery is properly insulated, and that the negative plates are not allowed to come into contact with the lining, no depreciation through peroxidisation will occur. Similarly, if the lining is protected from any action by wood acids and is made of chemically pure sheet lead, no pitting will take place. Drainage between the lining and wood container is useful to carry away any condensation moisture, or to reveal a leaky lining quickly.

The relative height of the container to the height of the plates may easily be standardised; excessive freeboard above the plates would have serious drawbacks.

The depth of space below the plates should be deep enough to avoid frequent removal of the sediment, but not so deep that the acid in the electrolyte gradually settles down at the bottom of the cell. The space at the end of the plate section might quite definitely be standardised. Some space is desirable to keep the negative plates from the lead linings, and also to obtain the readings of the specific gravity of the electrolyte.

The actual shape of the plates is a matter which calls for too much difference of opinion to standardise, but the thickness of the plates can be agreed upon, and the minimum weight in pounds per ampere-hour capacity at a definite rating can be fixed in consultation with the battery makers. It might also be possible to agree upon a range of standard widths of plates in order to ensure a common pitch or distance between cell centres. The dimensions and shape of the supporting and current-carrying lugs might also be standardised, and thereby ensure that a replated battery will still present a sound engineering design irrespective of the make of plates. The distance between the plates determines the bulk of acid, the length of the cell, and the range in the specific gravity of the acid on discharge. If the thickness of the plates and the separators be standardised, then the battery user is able to requisition plates of any make for renewals. Having established a standard for the pitch of cells and width of plates, it is possible to standardise the dimensions of the channel bars and agree upon a fixed weight of these bars per unit length.

There is no reason why cell insulators should not be standardised, at least as to dimensions and design, assuming that British manufacture is stipulated. The number of manufacturers in this country is very limited, but it is worth noting that British-made green-glass insulators are in every way superior to foreign makes. The quality of the electrolyte is at present met by the expression "suitable for use in storage batteries." A specification might be drawn up by a Standards Committee bearing in mind that some of the Government departments have already put their house in order in this respect. Not only is the quality of the acid open to standardisation, but the normal working specific gravity of the acid in large stationary batteries can be fixed without any difficulty. The bulk of the acid for a given ampere-hour capacity at a definite rating is almost fixed by the above points, and may therefore be standardised.

It may be thought that so many items are open to standardisation that the variables are insignificant, and all batteries would consequently be alike. This is not the case, for there would always be master patents in the hands of one or other of the manufacturers, and workshop recipes, processes, dearly-bought experience, and reputation would all remain as jealously guarded as heretofore.

One of the most important improvements in modern storage battery practice is without doubt the practical adaptation of wood diaghragm separators. This involves the use of selected timber only, and an effective process to eliminate the wood acids and resin. Wood separators cannot be standardised in detail owing to the various patents covering their manufacture and treatment.

Construction of boxes or containers is a subject upon which opinion is divided. The present designs run on two well-established principles, namely:—Panel type, and solid wall type.

Cells constructed on either principle are giving satisfaction in service, but panel boxes appear peculiarly adapted for really large batteries. The combination of cheap timber and expensive paint will give better results than expensive timber and cheap paints. This question of a protective paint is of far greater importance than engineers appear to realise. The paint should be heavy bodied, acid-proof, and non-evaporative.

There are two distinct methods of building up the container linings—the mitred type, and the block bottom type, each of which has its advocates, but the question of cost is liable to be placed before that of efficiency. For very large cells the author advocates the mitred method in preference to the block bottom type, but not to such an extent as to recommend that it be standardised in specifications.

A table has been compiled from specifications issued during the past five years to show the wide variation in specified points, almost all of which might very well be standardised. There is some information to which everyone will agree; for instance, the number of cells for a given bus-bar voltage; the final voltage per cell at any given rate of discharge; the percentage capacity at various ratings, taking the five-hour rate as 100 per cent.; the ampere-hour efficiency of the battery; the watt-hour efficiency of the battery; the normal and maximum charging rates expressed as a percentage of the five-hour capacity; the maximum difference of potential attained by the battery on charge. Add to these the points open to standardisation in battery design and an equitable method of testing, and the battery specification emerges as a tangible technical proposal instead of a collection of irrelevant and inconsistent stipulations.

Should the author's proposals *re* standardisation be taken up and put into concrete form he advocates that the specification be revised at least every three years. This is important because advances in storage-battery design have not reached finality, and the makers now labour under the handicap of having to conform with specifications in several instances drawn up many years ago, and obviously out of date in important details.

The absence of official standard tests is felt acutely. Methods employed for testing the efficiency of a battery vary between exactly opposite extremes.

It is unnecessary to stipulate a standard method of testing for all batteries, but alternative methods might be standardised, and the particular one selected by the engineer should be specified. One satisfactory method of testing is to discharge the cells at a specified rate to a fixed final difference of potential, then to recharge the cells to an extent equal to 10 per cent. more than the number of ampere-hours discharged, and then to repeat the discharge. This will give the effective capacity and efficiency of the cells on the particular cycle, and will demonstrate the percentage margin of capacity possessed by the cells over their guaranteed output.

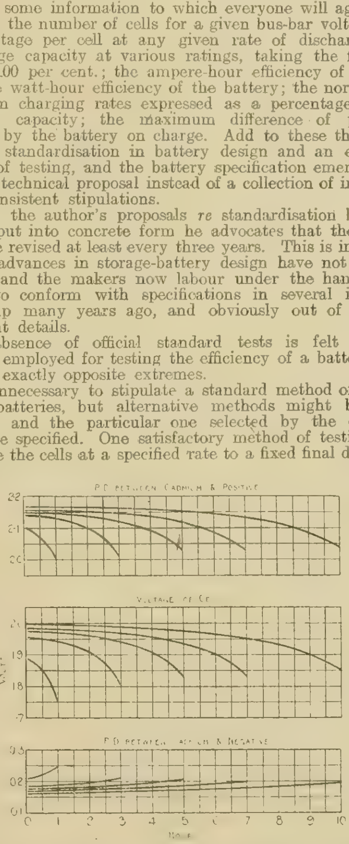

Fig. 1.—Curves showing Voltage of Cell during Discharges at Various Rates, with Cadmium Readings of Positive and Negative Elements.

Another method is to discharge the battery at a specific rate of discharge to the guaranteed output, and if the voltage across the battery terminals does not fall below the prescribed limits this will prove that the battery has its guaranteed output. The battery should then be recharged, putting back 10 per cent. more ampere-hours than the guaranteed output, and the discharge should be repeated. The battery will have passed its test if on this second discharge the guaranteed output is again obtained without the voltage across the terminals of the battery falling below the prescribed limit.

The author favours this latter method for large batteries, because if the battery is to be maintained up to 100 per cent. of its guaranteed output, and this output is not to be exceeded at any time, the determination of the margin in capacity does not necessarily form part of the official test.

The diagnosis of a test is not generally appreciated. If a battery is low in capacity it is comparatively easy to locate the cause of the weakness. The hydrometer and cell-testing or switchboard voltmeter will indicate that weakness is present, but will throw no light on the actual cause. The metal cadmium affords a ready means of determining the relative condition of the positive and negative elements. Fig. 1 illustrates the method by which this diagnosis can be applied. The central diagram shows the curve of voltage of a cell during discharge at various rates. The upper diagram shows the curve of potential difference between the positive element and cadmium during discharge. The lower diagram represents similarly the potential difference between the negative element and cadmium. It may be noted that the voltage of the cell at any point represents the difference between the two values —potential difference between positive and cadmium and potential difference between negative and cadmium.

(To be concluded.)

Discussion in London.

Mr. C. H. Wordingham, President, said that with regard to standardisation there should be no difficulty in the matter with the Engineering Standards Committee. He agreed that battery tests required standardisation, but as to the design of cells he was not quite so sure. The Committee generally kept away from maintenance agreements, these being outside its scope, but the I.E.E. could form a committee to deal with this subject, and as to the question of paint, this could be referred to a panel of the Insulation Committee.

Capt. A. M. Taylor was particularly interested in the author's remarks relative to stand-by batteries. Opinions might be divided as to whether it would be better to have a battery which would give, say, 80,000 amperes for 10 minutes, or 25,000 amperes for one hour; but if one and the same battery would give *either*, then that was an asset of great value. It would be interesting to know what was the relative capital cost of such a cell, which he believed was made of thin plates, as compared with a cell intended for discharges up to three hours, or more, regularly. Did a battery really pay its way, not, of course, at the present price of lead, but at pre-war prices? It was essential that station engineers should agree as to the actual cost of the current put into the cells if put in at non-peak hours. Captain Taylor had maintained all along that this particular charging current only cost about 0.15d. per unit. If this were granted, and if he took the fixed charges—including up to the sub-station L.T. bus-bars—for one of the largest municipal generating stations* at £5 8s. per KW. of maximum demand per annum, and stand-by coal at 10s. per KW. of maximum demand, and pure running charge at 0.15d., then (*a*) With a load factor of 20 per cent. the cost of 1,752 units was at the rate of 0.959d. per unit; (*b*) with a load factor of 30 per cent. the cost of 2,660 units was at the rate of 0.684d. per unit, in each case with steam alone.

Considering the extra expense to the steam side of the station caused by the charging of the cells, neglecting the reduction in steam plant effected for a given maximum demand, 25 per cent. of the load curve area being put into the cells in the case of (*a*), and 33 per cent. in the case of (*b*), and 50 per cent. total loss, including boosters, being allowed in each case, they then got the following:—

(*a*) 20 per cent. load factor:—1,752 units at 0.759d. and 219 (waste) at 0.15d. = 0.98d. average per unit effective. Lost units represent only 1.6 per cent. of the total cost of the whole station.

(*b*) 30 per cent. load factor:—7,660 units at 0.684d. and 443 (waste) at 0.15d. = 0.707d. average per effective unit. Lost units represent only 3.64 per cent. of the total cost of the whole station.

The cost (including all charges of every sort) of the useful units actually obtained out of the cells (taking fixed charges for cells as in fig. 1)* delivered, as in the case of steam, at sub-station bus-bars where battery would be placed was:—

(*a*) 20 per cent. load factor:—1.2-hour rate, fixed charge £1 12s. per KW. per annum. 438 units at 0.88d. + 0.15d., and 219 (waste) at 0.15d. = 1.03d. Cost per effective unit = 1.105d. per unit, as against steam at 0.959d.

(*b*) 30 per cent. load factor:—2.43-hour rate, fixed charge £2 per KW. per annum. 886 units at 0.52d. + 0.15d., and 443 (waste) at 0.15d. = 0.92d. Cost of effective unit = 0.765d. per unit, as against steam at 0.684d.

The difference between the two costs would disappear if a rather smaller steam station were considered.

Mr. R. Crawford said he was glad to hear that tiles were going out of use as battery-room flooring; the acid was apt to get between and beneath the tiles, and the floor was thereby quickly ruined. Regarding fig. 3 in the paper, he said the weight of a battery should be taken up by the building itself, and not by the floor alone. In countries abroad the gravity of the acid was affected by heat much more than in this country, and this point should never be lost sight of by such users. Personally, he was biased in favour of booster regulation, and also he was in favour of the 10 minute rating. He thought the chief use batteries would be put to in the future was for stand-by purposes.

Mr. C. G. M. New agreed with the author's remarks as to battery standardisation, and he thought battery makers would also welcome the idea. Government specifications were impossible, and there had been difficulties in connection with the tests imposed by the Post Office. Station engineers and staffs too often looked upon the maintenance agreement as relieving them of all responsibility, so that it did not matter what became of the battery, or how it was handled. A point that was important, and should never be forgotten, was that the life of a battery was measured, not by time, but by the number of discharges it was subjected to.

Mr. Ll. B. Atkinson said he had occasion recently to build a floor which would have to withstand very similar conditions to a battery-room floor, and he had found the best material for use in making such floors was Staffordshire blue brick, which was quite acid-proof. Asphalt was a combination of natural bitumen and limey substances, and was not suitable for use in making battery-room floors. On making inquiries he had found a gas company who were prepared to supply a gas-tar pitch for use in place of ordinary asphalt which was perfectly acid-proof. This gas-tar pitch, together with Staffordshire blue brick, made the most suitable flooring, he thought.

Mr. R. Rankin said an adequate water supply was essential to every large battery; too often one found dirty water being used, with consequent damage to the battery. Provision for getting rid of the waste acid was most essential. The efficiency of a battery was greatly affected by the auxiliary plant used in connection with it, and the latter should, therefore, always be kept in good working order. There was a question as to which type of cell was preferable—the deep or shallow cell. In a deep cell the acid was not uniform, it became much stronger at the bottom. The evaporation was practically the same in both types of cell, but in the case of the shallow cell the level of the acid remained much more uniform.

Mr. E. T. Williams said the paper was a very valuable one, and the greatest difficulty which had to be overcome was the "irreconcilable prejudice against batteries" which the author had mentioned. More attention should be given to the maintenance and repair of batteries. It should be remembered that "a stitch in time saves nine," and users of batteries were too often apt to let things slide until it was too late to make proper repairs. Batteries were very often most unsuitably housed, and another common fault was that in many cases the battery was designed without due consideration of the future expansion of the supply, and in consequence, after a short time, the battery had to be overworked. It was most important that a battery should be properly used, and details must never be neglected. He understood that quite recently a satisfactory acid-proof cement had been made. Touching standardisation, he said this was very important, and most desirable. It should be noted that in batteries destined for the Tropics more allowance must be made for expansion; plates were frequently buckled through not having sufficient room to expand. He thought that the future use of batteries would be mainly in the nature of a stand-by, or to meet short, heavy peaks. He had recently had to consider the supply of three towns, and after going into the various methods available he had been struck by the many points in favour of a battery in each town, all supplied from one central station. He thought the question of installing batteries on consumers' premises should be gone into more fully, because they could in this way increase the load factor, and enable lower charges to be made.

Mr. E. C. McKinnon, in reply, said that nearly all specifications to-day were quite useless, because in many cases very old ones were used over again with simply a few figures altered to meet present conditions. It was not now usual to cover paint with varnish; when paint was used it must be good, and a thick coating should be put on. He thought that in this country we were following five years behind the U.S.A. in central-station practice. It was thought quite ample in the U.S.A. if the battery was capable of taking up the load for 10 minutes. Here, in this country, only a very mild protest was raised when the supply happened to fail; it was very different in the U.S.A. It was very difficult to say whether booster regulation was better than other systems, and as to capital cost of a stand-by battery, it could not be given owing to present prevailing conditions. In an up-to-date battery room the floors were by no means wet, in fact they were often dusty, and both cement and tile floors were quite satisfactory provided the latter were properly jointed. Bare aluminium conductors deteriorated very quickly, and welded joints were not easy to make. Bolted joints were simpler, but copper conductors were easier to handle and work in every way. With regard to wood separators, an old battery could be improved 25 per cent. by their use. There was no difficulty in disposing of waste acid, as there was always a ready sale for it. The battery tests in use to-day were most crude; if the number of discharges of a battery was taken as its life the agreement would run out in about three years, and the human element must not be forgotten when a maintenance agreement was being drawn up.

Discussion at Birmingham

Mr. E. C. McKinnon's paper on large batteries for power purposes was read and discussed before the Birmingham Local Section of the Institution of Electrical Engineers on April 17th.

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* See table in the *Electrician*, December 4th, 1907.

Mr. G. Rogers said the paper would prove a useful guide to engineers who had to consider the question of installing batteries for power purposes. The author was rather severe upon the engineers who had been responsible for the drafting of battery specifications, but it must be remembered that the educational facilities for large battery work had been non-existent. With regard to the author's remarks upon the obstructing factors which had caused delay in the progress of battery installations, he would like to draw attention to another factor, the failure of battery makers to meet their responsibilities under maintenance contracts. Battery makers neglected to watch the daily records, and delay ensued in carrying out the necessary repairs. The terms of the maintenance contracts, and the representations of the manufacturers to their customers as to the treatment of their battery plant had largely been responsible for the idea that batteries had to be treated as invalids. The maintenance department should be in constant touch with all records, and be regular in the periodical inspections; the instructions for the working of the battery should also be stated as simply as possible. It was very interesting to note than an English engineering firm was now prepared to turn out large switches for use with regulating cells. From the diagram these switches bear a great resemblance to the switches supplied by Siemens, of Berlin. One feature, lacking in the Siemens switch, was very important, viz., the switch was capable of being operated and cells cut in when the load was considerably more than the full rated load of the switch. He was inclined to think that in this country the developments of electrical supply were likely to cause a decreasing demand for batteries. It would seem that the distribution of power for lighting and power purposes in the future would largely be by means of three-phase, four-wire networks. It must be remembered that cheapness of supply would be the dominating factor in this development, and reliability and continuity of service would have to be provided by means of duplicate supply. The losses incurred in the use of converting plant and battery auxiliaries would therefore be avoided. Even the country-house battery plant was likely to be superseded sooner or later by the transformer. There was, however, likely to be a demand for buffer batteries for use with traction systems if direct current was eventually adopted for the electrification of railway systems.

Mr. F Forrest said large batteries, whether for stand-by purposes of for more general use, were likely to be installed in stations situated in crowded areas. Owing to the great volume of acid-laden air which would be discharged from battery rooms containing large batteries, it was necessary to prevent this being a nuisance to surrounding property owners. "Acid neutralisers" had been in use for years in the U.S.A., but very few had been installed in this country. Two were erected in one of the sub-stations in Birmingham, and had proved very satisfactory, these having been built to designs of the chief engineer of the New York Edison Co. An efficient distiller should form part of every large battery equipment. A very satisfactory arrangement was to keep the distiller working constantly, and to store the distilled water in wood lead-lined tanks mounted some distance above the top of the cells, so that the water could be drawn off by gravity. Before any of the distilled water was used, samples of it should be drawn off and tested, either with the Dionic water-tester or by the nitrate of silver test. A portable milking booster was also a necessary accessory, and a very good form to adopt was one which combined on a single carriage the small motor generator, together with all necessary switchgear and instruments. A number of concentric plugs should be arranged round the battery room so that the polarity could not be altered, and as far as possible the machine should be rendered fool-proof. The whole equipment should be mounted on rubber-tired wheels, and arranged to turn into any of the gangways with ease. The watt-hour efficiency of a battery was so difficult to accurately determine that he suggested it should be no longer included in battery specifications. Ampere-hour efficiency was really all that one wanted to know, and that should be the standard upon which to frame guarantees. To obtain the watt-hour efficiency it was necessary to re-charge a battery to exactly the same condition in which it was before the discharge test commenced, and it was almost an impossibility for even an expert to state when a battery was in precisely the same condition, both as regards its voltage and specific gravity. A short period of under-charging would improve the apparent efficiency and upset the accuracy of the test. The usual type of hydrometer in use was a rather unsatisfactory means for testing the condition of large batteries, and he asked the author whether he was acquainted with any other form of hydrometer having a larger and better defined scale than the small things one was compelled to use at present. Working to specific gravity alone was one of the most satisfactory ways of operating a battery, and it was, therefore, very essential that the hydrometers used should be of the best possible type. With regard to the control of large batteries there were in use in Birmingham a number of regulating cells generally of the type illustrated in the paper, but unfortunately, these were obtained from abroad. Each half battery in connection with a three-wire system was controlled by one of these switches, which was connected between the neutral point and the battery, so that there was a minimum voltage to earth on the switch. This was a very important point to watch in connection with either boosters or cell-regulating switches. The working results with large and small batteries had demonstrated that the trouble experienced was inversely proportionaly to the size, and those people who had connected solidly to their bus-bars a large battery appreciated its value, especially in times of emergency.

REPORT OF THE BALFOUR COMMITTEE ON POST-WAR TRADE POLICY.

The Committee on Commercial and Industrial Policy After the War, which has been presided over by Lord Balfour of Burleigh, was appointed in July, 1916. Its reports—four in number—have just been issued by the Ministry of Reconstruction. Three interim reports deal in detail with certain branches of the problem, and a final report embodies briefly the conclusions of these three and adds final conclusions.

In regard to the position of British trade and industry at the outbreak of war, the Committee find that the older industries, with one important exception, showed at that time great vitality and power of expansion. This exception was the iron and steel industry. In this manufacture, and also in the newer branches of industry (chemicals, metals, electrical appliances, &c.) Great Britain's position was not nearly so good. In the general world expansion of these manufactures Great Britain had taken a very limited share. In numerous branches of trade, outside the great staple trades, foreign competition had become increasingly acute, and foreign manufactures had secured a strong, or even predominant, position; several branches of production, of greatest importance as bases for British manufactures, had come to be entirely or largely under German control.

Great progress towards remedying this condition of things has been made during the war, and the Committee think that the experience gained should be a most valuable asset, but they emphasise the importance of every effort on the part of employers and employed to attain the largest possible volume of production in order to secure the speedy recovery of our industrial and financial position.

They recommend that the present prohibition of the importation of goods of enemy origin should be continued, subject to licence in exceptional cases, for a period of at least 12 months after peace, and for such further period as may seem expedient; also that the British Empire and the Allies should adopt a policy of joint control of the export of certain important materials which will be required for the restoration of their industries. As part of these arrangements the Committee recommend the Government to consider the establishment of a joint organisation for dealing with Allied orders for reconstruction purposes. It will be necessary, they consider, to continue for some period after the war some part of the control of home and foreign trade imposed during the war in order to secure adequate supplies of foodstuffs and raw materials, and their fair distribution. But such restrictive measures should be kept within the narrowest possible limits, and, wherever practicable, the trades and industries themselves should be entrusted with this control, under Government authority. State restrictions on industry should be removed as soon as possible after peace.

As to the supply of raw materials, the Committee consider that any attempt to make the Empire self-supporting would be neither practicable nor economically sound. They favour a "selective policy" which shall have regard to the relative importance of each commodity, whether industrial or military, the sources of supply, and the likelihood of their disturbance in case of war. This method would yield more rapid progress, they consider, than the proposal made by the Dominions Royal Commission to establish a single Development Board. Special inquiries should be instituted, they consider, on the lines of the Committee now investigating supplies of cotton within the Empire, to deal with each commodity that may be selected for treatment on the principles suggested, the general aim being to assure that the Empire in an emergency should be independent, for its supply of any essential commodity, of any single foreign country or possible combination of countries.

The subject of essential industries is dealt with in considerable detail in one of the four reports, which shows how certain of the largest British industries had come to be dependent upon enemy sources for relatively small, but essential, commodities. The Committee recommend as a national safeguard against any recurrence of this condition that a Special Industries Board should be established, having the duty of watching the course and trend of industrial development, and of framing from time to time detailed schemes for the promotion and assistance of industries concerned with the production of these essential commodities.

With regard to the position of aliens, the Committee while thinking that in the main it would not be desirable to impose restrictions on the participation of aliens generally in commercial and industrial occupations, recommend the reservation of certain occupations, such as pilot and patent agent, to British subjects. They suggest also the licensing of foreign commercial travellers, the registration of all titles to property, with a declaration as to the nationality of the owner or transferee; powers for the Board of Trade to investigate the ownership and control of any particular company; licences for foreign banks and insurance companies, and, in the case of the latter, the lodging of a money deposit; stringent police regulations for a period after the war concerning subjects of present enemy countries. It would be impracticable, the Committee think, and inexpedient to impose any restrictions as to the use of London credit or insurance facilities. [We referred to the Committee's conclusions regarding trade organisation last week, p. 387.]

On the subject of financial facilities for industry the Committee are not able to recommend the scheme for the establishment of an Imperial Bank of Industry. The financial needs of British industry, they consider, are likely to receive better examination, and to be met in a more effectual manner, under private banking enterprise than under a State-controlled institution. As a general rule, they think it undesirable that the State should attempt to provide capital for industrial purposes. The Committee also recommend investigation as regards taxation (especially in connection with the income-tax allowances for depreciation of industrial plant), currency, and for the maintenance of foreign exchanges, such as is now being carried out by Committees of the Ministry of Reconstruction and H.M. Treasury. The remedy for shortage of capital after the war, however, must be sought mainly, the Committee consider, in the increase of production and saving. Appreciable aids to these ends can be found in the avoidance of unnecessary expenditure by the State, and in the extension of the taxation of luxuries.

The Committee make recommendations as to fiscal policy in the light of war experience. First, they lay down various propositions as the bases of future economic policy. Among them are:—

1. Government action to promote and safeguard "pivotal" industries (industries on which depend other and larger branches of important national production).
2. Government assistance to industries which are important for maintaining the Kingdom's industrial position, but which are unable to develop themselves by reason of undue foreign competition or other causes.
3. Efforts to meet the declared wishes of the Dominions and Colonies and India for the development of their economical relations with the United Kingdom.
4. Efforts to develop trade with our Allies.
5. Subject to agreement with our Allies, the refusal for a time, at least, of trading facilities to present enemy countries on the same unrestricted terms as before the war, or on terms equal to those accorded to Allies or neutrals.

A majority of the Committee do not think it expedient to establish a comprehensive tariff scheme covering the whole range of imports into the United Kingdom, and they advance the following reasons for their opinion:—

1. A claim for protection cannot be regarded as valid unless the industry which makes it can show that, in spite of the adoption of the most efficient technical methods and business organisation, it cannot maintain itself against foreign competition, and that by such competition, it is hindered from adopting these methods.
2. There are large branches of production (as in the cotton trade) in which there is no demand for any measure of protection.
3. Any State action towards the indiscriminate maintenance of industries which do not contribute appreciably, or at all, towards the national wealth would be economically unsound.
4. Any State action likely to raise prices, even temporarily, for commodities of national importance should be confined to the closest possible limits.
5. It is of paramount importance that our export trade should not be hampered by any policy which might unduly increase the cost of production in this country, as compared with the cost in other countries; and a more limited tariff could be used equally well, though not so extensively, for granting Imperial preference, and for the purpose of negotiation with foreign countries.

The Committee, after examination of the main considerations involved, come to the following conclusions:—

1. Producers in this country are entitled to protection against "dumping" and the introduction of "sweated" goods, and Government action on the lines adopted by Canada is recommended.
2. "Pivotal" or "key" industries should be maintained at all hazards and at any expense.
3. In other industries protection, by means of Customs duties, or Government help in other forms, should be provided only for reasons of national safety, or on the general ground that no industry of real importance to our economic strength and well-being should be allowed to be weakened by foreign competition, or brought to any extent under alien control.
4. Preferential treatment should be accorded to the Oversea Dominions and Possessions in any Customs duties now or hereafter to be imposed in the United Kingdom, and consideration should be given to other forms of Imperial preference.
5. The present opportunity should be taken to promote our trade with our Allies, and consideration should be given to the possibility of using for purposes of negotiation with them and with present neutrals any duties which may be imposed in accordance with the foregoing principles.

The Committee add that, in view of the danger that the admission of the principle of protection, even to a limited extent, may give rise to a widespread demand for similar assistance for other industries, and consequently to an amount of political pressure which may be difficult to resist, they recommend the establishment of a strong and competent board, with an independent status, to examine all applications for State assistance, to advise the Government upon them, and, where a case is made out, to frame proposals as to the nature and extent of the assistance to be given. Before recommending tariff protection this board should consider forms of State assistance other than, or concurrent with, protective duties. It should have constantly in mind the safeguarding of the interests of consumers and of labour.

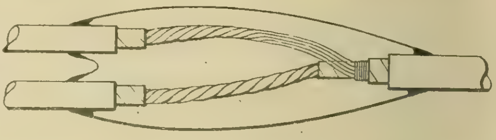
The report comprises chapters on the metric system and decimal coinage, neither of which the Committee felt able to recommend for adoption in this country.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Joints on Triple-Concentric to Three-Core Lead-Covered Cables.

I have read Mr. Wardle's article in the ELECTRICAL REVIEW, and may state that I have made joints on the same principle, but without fittings, on the triple-concentric cable. I used to put a tinned copper binder, 1½ in. long, on the concentric, intermediate and outer, lay the wires together, making a core, and then telescope on to three-core cable, sweating all solid from the tinned copper binders to the telescopic joint. The different engineers I have worked under have found, by telescoping the joints, that a smaller lead sleeve can be used than with fittings. I enclose a rough sketch, showing how I have, also, in several instances, jointed two single lead-covered cables to a concentric cable, making the lead sleeve into a trousers joint. I have been a cable jointer for 24 years, and a foreman plumber jointer for the last 15, so write from experience.

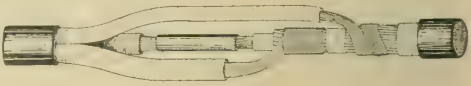


P. H. Williams.

Charlton, S.E., *April 27th*, 1918.

Referring to the article by Mr. P. Wardle in this week's issue the enclosed sketch shows a method which has been adopted in this district, whenever necessary, for the past 14 years. The positive or centre core of the triple-concentric cable is either telescoped or jointed with a metal sleeve to one core (clover leaf) of the three-core cable.

The negative and mid-wire cores are stripped back about 2 in., with 1 in. of insulation between each, the copper slightly raised, and a piece of tinned copper strip put underneath with mica between this and the paper insulation. The wires forming the cores of the three-core cable are then spread out and laid round the concentric cores and bound down with binding wire, the whole joint then being sweated solid in the same way as if it were a concentric to concentric joint. Each core and joint is insulated with tapes boiled in resin oil.



A ·2 ·1 ·2 triple concentric to ·2 ·1 ·2 three-core joint of this character can easily be got into a 3½-in. lead sleeve, and a ·3 ·15 ·3 three-core to ·6 ·3 ·6 triple-concentric joint has been got into a 4-in. sleeve.

Several of these joints have been in use for years, and we have never had the slightest trouble with them.

F. D. Balshaw,
Willesden Electricity Department.

Kilburn, N.W. 6.

Coil v. Magneto.

With reference to the letters on the above by Mr. E. G. Ford and "Unsettled" in the "Correspondence" columns of your March 22nd and April 5th issues, many points of interest to readers are raised, and as I have devoted considerable attention to car lighting, starting, and ignition by electrical means for some years, I will endeavour to make a few observations and suggestions as the result of experiment and experience.

Dealing with Mr. Ford's query as to a good coil system being superior to magneto, there is so much in this connection that is still debatable that I prefer to assume this to be still an open question.

To begin with, what is a good coil system? There is the "auto-sparker" single-wound coil used in conjunction with a small D.C. generator, the double-wound (primary and secondary) coils with and without tremblers, operated either by dry cells, accumulator, D.C. dynamo, or, in the case of the Ford car, by an alternating-current generator, and many other systems. All have their virtues and their vices, and whilst some years ago British manufacturers were casting about for some finality and standardisation in car-coil ignition systems, the Bosch Co. fairly captured the field by their energetic and systematic production of really high-class magnetos.

I think the present position could be summed up by saying that the magneto holds the field, owing as much to energetic manufacture and "fashion" as to its reliability as compared with a developed coil system such as is seen on the Ford car. The success of the latter seems to have proved an incentive for reversion to coil ignition in America, as mentioned in the ELECTRICAL REVIEW a little time back.

One of the most distressing troubles met with in connection with coil ignition systems has been due to the platinum points in the trembler. Attempts to eliminate the trembler wholly or partially, relying upon the single spark produced by the sudden "break" of the contact device attached to the engine timing gear for ignition, have now been practically discarded owing to the single chance of the single spark to do its work of producing proper ignition at all times without "missing." It is true that the magneto gives practically a single spark for each "firing," but unlike the spark from a coil (without trembler) its spark is not momentary, but, to a certain extent, "sustained." I think it is, therefore, manifest that, owing to the nature of the discharge from a coil, the trembler device must be considered an essential to faithful operation.

Having got thus far, let us examine the causes of platinum contact troubles. In the early coils these were due to (1) bad design of coil windings and dimensions relative to the operating current; (2) area of contacts much too small for long "life" before requiring adjustment or renewal; (3) the exclusive use of continuous current for operating the coils. The latter statement may cause surprise in some directions, but I find that alternating current to operate trembler coils does not burn up the platinums anything like so soon as current (continuous) from a dynamo or battery. I will not explain here why this is so; I simply give it as a fact of experience. The first two drawbacks have now been overcome by proper design and good robust platinum contacts. Number three seems to be minimised in its effects by the alternating-current system, for which the Ford car can claim to have given us an improvement; but, in spite of the advantage of alternating current, I have obtained very satisfactory results with battery operation—enough, in fact, to justify the assertion that the coil can quite hold its own with the magneto. If "Unsettled" knows of a really good contact breaker, apart from the ordinary design, or modifications well made, I suggest that the world would welcome it, so please tell us more about it, as the times are too momentous for anyone of inventive genius to hide his light under a bushel.

There is just one other point which I will briefly refer to, and that is that the magneto has gained a lot of its popularity owing to the respect with which it has been treated by the average run of motor mechanics. If a magneto has got "out of sorts" it has generally been returned to its maker, whereas coil systems have been "tinkered to death" by a host of "motor traders," whose only reputation for ability or claim for competence seems to be to belong to one of the "Motor Trade Protection Associations" formed for that purpose.

It is a fact, I believe, that these Associations have the temerity and audacity to protect their members to the point of excluding qualified electrical men from doing electrical car work, by forbidding their members (manufacturing) to supply electrical firms at trade terms. The result of this organised prejudice has been to hinder progress, but, mark this—only for a time.

When this ghastly war is over, Electrical "Protective" Associations will see to it that the present motor industry "poachers" are cleared out, and that "coil or magneto," or any other useful electrical device, will have fair play in cars or anything else, and not be at the mercy of the ignorant or the whimsical.

J. R. Parkington.

Newcastle Emlyn, S. Wales,
April 29th, 1918.

The Electrical Power Engineers' Association and the Association of British Electrical Engineers.

"Doubtful," in his letter published in your issue of April 26th, puts his finger on one of the weak points of the proposed Association of British Electrical Engineers. Independently of the Whitley Reports, the legal position is this: That a body of this kind must either be incorporated, or registered as a Trade Union. (The possibility of operation under a Royal Charter cannot profitably be considered at present.) If the Association be incorporated it is at once debarred from obtaining any financial benefits for its members; consequently its principal object, the increase of insufficient salaries, becomes impossible of attainment. If it were neither incorporated nor registered as a Trade Union it would have no legal status, and in the event of any drastic action being forced upon it—not by any means an impossibility—its members would presumably become liable to a prosecution for conspiracy. The high and mighty "in no sense a Trade Union" thus reveals itself under analysis as a very futile piece of snobbishness.

This matter was several months ago very carefully gone into by the Electrical Power Engineers' Association, and, legal advice having been taken, this body had the good sense to see that registration as a Trade Union was the only sensible course to adopt at present, and by this policy it not only becomes a legal entity, but is also entitled to look after the financial interests of its members, to enter into negotiations as an organised body, to representation on Industrial Councils, and to all other privileges which Trade Unions enjoy. At the same time, mere Trade Unionism by no means contents it; its ambition is to become a professional association of engineers, membership of which should be a hall-mark of electrical engineering ability.

Although the E.P.E.A. has only been in existence a few months, it already numbers over a thousand members, who are drawn from all grades, from chief engineers and chief assistants downwards. It is obvious, therefore, that no considerations of "dignity" ought to prevent any qualified electricity supply engineer from doing his plain duty to himself and his fellow engineers by joining the Association, which is already a living force. To sit on the fence or to support any other body setting up to be a protective organisation is to weaken our forces and to waste our opportunities. The only doubt on this matter which ought to exist in anyone's mind is whether his qualifications are sufficiently high to entitle him to membership.

E. B. Pausey.

Bury, Lancs., *April 29th*, 1918.

With reference to the letter from "Doubtful" in your last issue, it may be interesting to know that the Electrical Power Engineers' Association has on many occasions of late been occupied in discussing the advisability or otherwise of Trade Union registration or incorporation.

We have in our ranks some who still blush at the thought of their membership of an Association with such registration as projects before their delicate imaginations a film in which "grousing," slackers and agitated tub-thumpers appear in scenes of "ca' canny" and down tools.

To correct their focus and disprove these erroneous notions, our president has arranged to read a paper on "Registered or Incorporated Societies," at a meeting to be held at an early date. We have made strenuous efforts to do the right thing in the interests of our members, and after careful consideration of all points of view, of Government action, of Whitley Reports, and having obtained the best legal advice, we decided on registration.

Our membership now comprises over 1,000 engineers, representative of all branches of the electrical industry throughout the country, many of whom are already members of the Institution of Electrical Engineers. Naturally, we would have esteemed it an honour had we the blessing of the premier Association, but always there has been this obstacle of the fixed idea, the illogical antipathy to Trade Unionism and its reputation aggressive. Curious that this should rest even on the E.P.E.A., whose loyalty has been tested and not found wanting, and whose mild activities would compare not unfavourably with those of any society of curates.

We have high ideals and bright hopes for the future of our "Trade Union," and are determined that we will bring no discredit on our profession.

We trust that by our conduct of affairs we may show the reactance utility of our Association to the whole industry, and that we may yet command the approval and respect of the I.E.E.

George C. Law.

London, S.W., *April 30th*, 1918.

[The point raised by "Doubtful" certainly appears to be of the first importance. We see no good reason why the B.E.E. should not register as a Trade Union; no discredit attaches to Trade Unionism in the abstract—it is only the *abuse* of the principles of Trade Unionism that has brought it into bad odour. The Whitley Report advocates the development of those principles and their extension to employers also.—EDS. ELEC. REV.]

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Lauraine High-Tension Magneto.

A new high-tension magneto, known as the Lauraine, has recently been put on the market by the Menominee Electric Products, Inc., of New York. The machine, which is of conventional design, is made in all standard sizes for motor vehicle, marine and tractor work, and is entirely waterproof; in addition, a special aircraft model is being manufactured, in which, by the use of aluminium and other light material, a saving in weight of about 4 lb. has been effected.

From the accompanying sectional view, p. 418, most of the important constructional details may be seen. The armature is of the Siemens shuttle type, and carries both the primary and secondary windings. One end of the primary winding is earthed on the armature core, while the other end is carried out to the contact breaker on the end of the armature shaft. The contact-breaker arm is built up of cross-sectional fibre working on a pin which is integral with the main contact-breaker block, thus preventing undue compression and expansion due to moisture or high temperature. The contact-breaker cam is cut from steel tubing, shaped, hardened, and ground to size, and it is claimed that, as a result of this construction, absolute synchronism is assured.

The high-tension current is collected from the armature through a collecting ring and brush at the driving end. The usual safety spark gap is provided, and the distributor gear is adjustable for wear. The waterproofing cover is inside the horse-shoe magnets; hence the magnets and also the end plate can be removed without disturbing the waterproofing, and the latter can also be easily removed, should it be desired. All castings, bases, and end plates of the machine are of bronze, while the armature is supported on annular ball bearings, and the distributor on a plain bearing of liberal size provided with wick oiling.

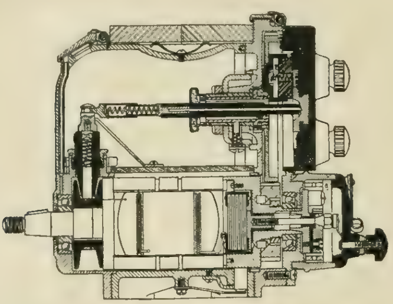


Fig. 1.—Section of Lauraine H.T. Magneto.

Electric Army Kitchen for Field-Service Use.

One of the developments made in the utilisation of electricity for war purposes is a portable electric army kitchen designed to meet the requirements of Red Cross and army field service. The kitchen heat is obtained by the combined use of an electric generator driven by the automobile motor and the heat from the exhaust of the motor, which amplifies the heat obtained through the use of electricity.

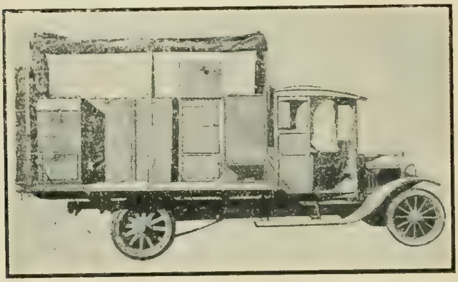


Fig. 2. Portable Electric Kitchen for Army Use.

The portable army kitchen is equipped with two 30-gallon fireless cookers, with a 26-hour cooking head efficiency: a 30-gallon coffee urn, a 30-gallon vegetable and soup urn, baking and warming ovens, and two large hot-water sterilising tanks, which are designed to sterilise 120 gallons of water in two hours. The generator develops a current which is said to throw a searchlight ray for 3 miles, and will carry a load of 600 110-volt lamps.

Because of the tie-up of the generator with the automobile motor, this kitchen can be operated either while travelling or while at rest.—*Electrical World.*

LEGAL.

Wireless Spark-Gap for Curing Shell Shock.

In the Patents Court, on Thursday, last week, Mr. E. E. Greville, of 167, Gray's Inn Road, London, maker of electromedical instruments, applied for licence to use a German patent—6,424 of 1909—for a wireless spark-gap, in the manufacture of an apparatus for curing shell shock. The application was heard by the Comptroller-General of Patents, Mr. Temple Franks, and Sir Cornelius Dalton.

Mr. H. A. Gill, patent agent, of 55, Chancery Lane, London, represented Messrs. W. P. Thompson & Co., of Liverpool, communicatees of the Gesellschaft für Drahtlose Telegraphie m.b.H., of Berlin, and explained that the main feature of the invention was a spark-gap having the electrodes placed very close together, and the surfaces of high thermal conductivity. The claim was "for an apparatus for producing but slightly damped electrical oscillations by the shock excitation method, and employing a very short spark-gap having parallel electrodes, in which these electrodes are made of a material which conducts heat as well as, or better than, gold." The feature was the use of such a spark-gap, preferably in annular form—in the constructional forms it was essential that all sharp edges should be avoided; there was a central gap, and the edges were enclosed by a ring of mica, or something of that sort. The patentee, to secure his high conductivity, went on to make up his plates in sets or series, with a series of water-cooling chambers between the spark-gaps. They were connected by cooling ribs with the electrodes. By the cooling means and several spark-gaps the patentee got longer range in wireless telegraphy. A simple spark-gap soon reached its limit. The energy converted into oscillations was increased beyond that limit by a plurality of spark-gaps.

Mr. Greville explained that the apparatus could be used for the high-frequency treatment of shell shock and nervous cases.

The Comptroller: Has this patent been used before for electropathic treatment?

Mr. Greville replied that, so far as he knew, the invention had never been so applied. He perceived its uses, however, in this field, and he proposed both to make and to sell machines working upon this principle. He would supply spark gaps as separate units for incorporation in existing machines, always to be used for medical purposes.

Mr. Gill said that the whole purpose of the apparatus was to get a longer range in wireless signalling. He was satisfied that the invention never contemplated such a use as that to which Mr. Greville proposed to put it.

Answering the Comptroller, Mr. Greville said certain modifications would be required when the spark gap was fitted to existing machines. He thought the price would be about £3, and he was ready to pay a royalty of 5 per cent.

Mr. Gill remarked that there were three previous patents which were germane to the present invention, but he did not think that any of them would affect the applicant's use. All seemed to be directed to wireless telegraphy. They were in the names of well-known wireless men—17,349 of 1908, in the name of Lepel; 4,809 of 1907, in the name of Poulsen; and 3,783 of 1907, in the name of Dr. Max Levy.

An engineer who was in Court watching the proceedings, interposed to say he understood that Mr. Greville was not applying for an exclusive licence, and that other people would be at liberty to apply.

The Comptroller replied that that was so. It was not the custom of the Court to grant exclusive licences. The whole theory of its work was that it was solely for the public benefit that these licences were granted. There was no other point of view. The Comptroller, in intimating the decision of the Court, said that Mr. Greville had satisfied the Court that there was good reason for supposing this invention might be of use in his profession. The Court saw no reason why the licence should not be granted, and Mr. Greville would accordingly be notified at an early date as to the issue of his licence.

White and Others v. The Mayor and Corporation of Dover.

Mr. Justice Bray and a special jury, on April 23rd, concluded, in the King's Bench Division, the hearing of an action in which damages were claimed by Mr. Albert White, the lessee of two houses in Folkestone Street, Dover, and Messrs. C. Ward and A. R. Adams, the freeholders, against the Mayor and Corporation of Dover, the electric lighting authority of the town, alleged to have been occasioned by the negligence of their workmen in laying an electric cable into one of the houses. The defendants admitted having laid the supply into the house in accordance with the plaintiffs' request, but denied that there had been any negligence in carrying out the work. They said that the only interference with the brickwork, which was very old, had been the removal of a single brick, which had been pushed out by a man's hand to allow the pipe carrying the electric wires to pass through from the roadway into the house. The hole thus made, it was said, was cemented up and made good directly the work was finished.

The case for the plaintiffs was that Mr. White, whose lease would expire in 1920, let one of the houses to a boot repairer, and that tenant at the end of 1916, being desirous of using electric current for the purposes of his business, for lighting, and driving a boot-repairing machine, applied to the Corporation to lay wires into his premises. They, as owners of the electricity supply of the town, accordingly undertook the work, and sent men to carry it out. They laid the cable in the ordinary way, but plaintiffs alleged that the work was done negligently, and that the brickwork of the foundation had been so disturbed as to cause a subsequent subsidence and a bulging of the walls.

Mr. Enoch Clarke, the tenant, said that when the cable was put in he heard the workmen using force upon the brickwork, through which they appeared to be driving a heading into the shop, and early in 1917 he found that the windows had begun to bulge both inwards and outwards. When he complained to the Corporation, they sent a man to put in cement or concrete.

Mr. Joseph Jennings, an architect of Canterbury, stated that upon examination of the premises he found that the brickwork had been disturbed, and that was the cause of the trouble. In his opinion, if proper care had been taken in putting in the cable the trouble would not have arisen. He estimated the cost of putting the matter right at about £100.

Mr. Barrington Ward (for the defence) asked the witness whether he had seen the premises since "the little encounter with the Germans," and witness replied that he had not, as it was not easy to get to Dover now.

Mr. White (plaintiff) recalled, said they were now repairing the shop front, which had been damaged by air raids, but they were not touching the "storey part," where the damage complained of had occurred.

For the defence, Francis Thos. Ashfield, a ganger on the electric staff of the Corporation, said that the work was properly done, and the brickwork was not disturbed. He had laid over 100 electric services in the town, and he never before had any complaint. The brickwork of the house was very old, and he had only to remove a brick with his hand in order to make the hole through which the pipe passed.

Mr. Wm. Beaston (architect), of Dover, and Mr. S. E. Beaufoy, Deputy-Mayor and builder, of the town, also gave evidence for the Corporation, and, in the result.

The jury found for the defendants, after an hour's consideration.

Workmen's Compensation.

His Honour Judge Hugh Sturges, K.C., reserved judgment, in the Preston County Court, last week, in a case in which Mrs. Bessie Gillcade sought to recover compensation from her former employers, Messrs. Dick, Kerr & Co., Ltd., for the loss of the second finger of her right hand. The injury was caused by the limb being caught in the machinery of a gear-box on an adjoining lathe on which she had placed her tea-can. The point was as to whether or not the use of the gear-box for such a purpose was permitted by the firm.

WAR ITEMS.

Ministry of Munitions Tin Order.—The Ministry of Munitions has issued an Order prohibiting the purchase and sale of, or other transaction in, tin situated outside the United Kingdom, except under licence. Except under such licence no tin may be used for the purpose of any manufacture or work except for Class "A" contracts. Monthly returns of tin have to be furnished to the Director of Tin Supplies, 1, Metal Exchange Buildings, E.C. 3.

Demobilisation Plans for Munition Workers. — The National Alliance of Employers and Employed are pressing that plans should be formed for dealing with demobilised munition workers in the same way as demobilised soldiers and sailors, including a month's furlough on full pay, financial help in the case of need, and preventive measures against unemployment.—*Times.*

Reconstruction in Belgium.—In view of the critical situation which will result for Belgium through the disasters caused by the depredation of the enemy, his removing of tools, raw materials, manufactured products, &c., there has been created, with, we are informed, the co-operation of, and under the control of the Belgian State, an organisation having for its object the economical reconstruction of Belgium. It is entitled "Comptoir National pour la Reprise de l'Activite Economique en Belgique" (Société Co-opérative), and its organisation is intended to help industry and trade by enabling them to purchase the tools and all necessary raw materials, and thus not only to reconstruct the economical situation of Belgium, but to put an end to the sufferings of the working classes by enabling them to start working the reconstructed shops. The Comptoir National is inviting English manufacturers and merchants to send catalogues and tariff in triplicate to its offices at 110, Cannon Street, E.C. 4, as it hopes to be in a position later to place contracts for metallurgy, materials for construction of buildings, leathers, textiles, farming implements, chemical products, wood machines, electrical material, optical instruments, motor cars, vans, wagons, oils and greases of all kinds, refractory materials, &c.

Exemption Applications.—The manager and secretary of the Dundee Tramway Carriage Co., Ltd., was granted temporary exemption till August 1st.

At Dover, a review was made of the case of E. W. Wright (40, C 1), electrician. Appellant stated that he was engaged in keeping in repair electrical machinery connected with munition work, and was also installing potato-pulping machinery. He thought he was entitled to a protection certificate. Six months were granted from May 30th.

At Romford, the National Service Representative had a review of the case of T. Holbrook (21), cable vulcaniser, with the Union Cable Co., Ltd., Dagenham Dock. The firm has received a protection certificate from the Munitions Area Dilution Officer, pending the provision of a substitute. The existing conditional exemption was withdrawn.

At Leek, the electrical engineer to the U.D.C. (Mr. Swarbrick) appealed for a fitter's assistant (18), but the Military Representative stated that he could not pass a youth of that age. A month was granted.—The same Tribunal heard a claim by an electrician for his only helper. Applicant said that he and his man both worked day and night, and also on Sundays. He was engaged on important work under the Ministry of Munitions, and had plans for erecting a factory where additional electrical work for the Government could be carried on. It was impossible to carry on the work by himself. Time was granted for inquiries to be made.

At Maidstone, exemption held by J. H. Baxter (31, Grade A), electrician to Messrs. A. E. Reed & Co., of Tovil, has been withdrawn, together with that held by J. P. Macrow (31, Grade A), engaged on the Corporation tramways, as he holds a munition area certificate. The Tribunal has adjourned the case of A. T. Lambert (41, B 1), manager of the Corporation tramways, for him to be regraded, and has given three months to E. Weller (32, B 1), metal turner at the tramway depôt, he to join the Motor Volunteers.

At Eastbourne, Mr. J. K. Brydges, borough electrical engineer, appealing for J. Godden (30, Grade 1), cable jointer and layer, said that his department had been weeded out rather drastically. The appeal was refused, the calling-up being suspended until the middle of May.

At Oxford, the National Service Representative asked for the withdrawal of exemption certificates held by W. J. Hawtin (38, Grade 2), C. W. Millard (37, Grade 2), and A. A. Withey (37, Grade 2), drivers, and T. Smalley (33, Grade 2), foreman driver, all employed by the Electric Tramway Co. Smalley was granted three months, Withey was ordered to report for service by May 1st, and Hawtin and Millard by June 1st. D. Campbell (38, B 1), foreman driver, was appealed for, and was granted three months' exemption.

Appeals were made at Hastings by W. Standen (37, Grade A), overhead linesman with the Tramway Co., and E. Blackford (40, Grade 1), fitter at the tramway power station. The former was directed to report for service by June 7th, and the latter within three weeks.

Herts. Appeal Court heard a one-man business claim put forward by M. J. Connare (38, B 2), electrician, of Watford. He said that he was engaged continuously in the maintenance of motors for electrical plant in factories, workshops, &c. It was urged that he was in a certified occupation. Lady Ebury: He won't be in it long. The Clerk: It really depends upon the grading. Mr. Gape, for the military, said that Grade 3 men who were electricians were wanted in the Army, and they were the only men in that class that he was entitled to ask for. The appeal was respited for re-grading.

At Barnstaple, the Corporation appealed for M. H. Mills (21), the only assistant electrical engineer at the works. Mr. R. E. C. Balsdon said that having regard to the recent comb-out order, affecting all men between the ages of 19 and 23, they had now to rely solely on the protection certificate of the Munition Area Recruiting Officer. Mr. H. P. Woodcock, National Service Representative, said that this certificate was withdrawn, and the man called up, but the Corporation applied for the case to be re-considered, and the calling-up notice was suspended. Mr. Balsdon said that if the man was taken the result would be disastrous for the town and its industries. Mr. Hadfield, the chief electrical engineer, could not work 24 hours a day continuously. Two men at the works were eligible for military service, and one had just gone. It was intimated that the Munition Area Recruiting Department was making further inquiries concerning the indispensability of Mills, and the appeal was therefore withdrawn.

At [illegible]es, three months' exemption, subject to substitution, [illegible] granted to R. Woodward (27, Class A), shift engineer at the electric light works.

At Chatham, on April 22nd, there was a review of the cases of S. W. A. Mercer (28, A 1), motorman, and F. Ralph (A 1), assistant overhead linesman, engaged with the Tramway Co. It was stated that efforts to find substitutes had been unsuccessful, and the staff of the company was now very low. A committee of the Board of Trade had been appointed to deal with tramway staffs, and it was suggested that the Tribunal should leave the matter with that committee. The Tribunal agreed that conditional exemption should stand, and notice of appeal was given.

At Oswestry, a Military appeal against exemption held by J. T. Jones (27), manager of the electric light works, was dismissed, and the exemption confirmed.

Colchester Tribunal has granted conditional exemption to H. Porter (37), fitter, and A. Pollard (38), shed foreman, engaged at the municipal tramway depôt, and decided that W. L. Barrell (37), painter, should join up by May 9th.

Peterborough Tribunal has granted conditional exemption, on the appeal of the Tramway Co., to E. A. Sewter (32, B 2), and F. Woodman (42, B 2), traffic inspectors, and A. V. Yeomans (24, C 3), car cleaner.

At Grays, exemption was asked for an engine driver at the U.D.C. electricity works (Grade 1), but the appeal was rejected.

BUSINESS NOTES.

Controlled Supply of Accumulators.—In our reference on March 8th (page 227) to the restrictions of the Ministry of Munitions (Priority Branch) our statement of Clause (3) has given rise to some misunderstanding. What it should have conveyed was the following:—In most cases batteries can be renewed up to 75 per cent. of their original capacity under a "Special Battery Permit" which is held by all the leading battery manufacturers, and without further reference to the Priority Department.

Capital Reduction.—On June 11th the High Courts will be asked to confirm a resolution reducing the capital of Pollock and Macnab, Ltd., from £60,000 to £50,000.

C.A.V. Moon Chart. — We are indebted to Messrs. C. A. Vandervell & Co., Ltd., for copies of their "May Moon Chart."

Nickel Alloys.—The Electrical Alloy Co., of Morristown, New Jersey, have materially increased the capacity of their mills, and are now in a position to dispatch shipments to Great Britain with reasonable promptness. Heretofore, the output of their mills has been mostly absorbed in the States. It is stated that on account of the many inquiries the company have received from Great Britain and the Continent, they contemplate establishing a branch here when "the common enemy is throttled and mankind can breathe peacefully." They have issued a complete catalogue describing the essential nickel alloys and resistance materials, which will be forwarded to interested engineers and manufacturers.

The Australian "Union" Electric.—Under instructions from, and on behalf of, the Controller appointed by the British Board of Trade, the following tenders have been accepted for the electrical plant of the Union Electric Co. of Australia, Ltd. :—Motors, starters, switchgear, M. H. Lauchian & Co., Sydney; instruments, fans, sundries, Engineering Supply Co. of Australia, Brisbane; carbons, A. Isaacs, Sydney; furniture, Amalgamated Wireless, Ltd.; arcs, Sutherland & Ashman, Melbourne.—*Tenders.*

Trade Announcement.—Messrs. W. L. Davies & A. Soames have granted an exclusive licence to the Equipment and Engineering Co., of 2 and 3, Norfolk Street, Strand, for the use of the "Daysohms" magnetic clutch for electric arc welding machines, which was described in the Electrical Review. Inquiries for welders fitted with this clutch should in future be addressed to the company named. Those for applications of the "Daysohms" clutches, other than arc welding, should be addressed to Messrs. Davies & Soames at Faraday House, 66, Southampton Row, W.C. 1.

Battery Manufacture in Spain.—La Transformadora de Electricidad is the name of a new concern which has lately been formed in Madrid to establish works for the manufacture of accumulators.

Catalogues and Lists.—Mr. George Ellison, Wellhead Lane Works, Perry Bar, Birmingham.—Abridged catalogue (86 pages), containing brief illustrated descriptions, prices, and dimensions, &c., of their circuit-breakers, A.C. starting gear, crane control gear, and other manufactures. Pamphlet No. 19 (eight pages) particularises and gives prices and dimensions, &c., of trailing cable sockets and plugs attached to totally enclosed air-break circuit-breakers.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—16-page pamphlet, giving illustrations and prices of a selection of different designs of electric light fittings. This has been issued to temporarily take the place of the full catalogue, which is out of print and cannot be re-issued in revised form under prevailing conditions. As our readers may be aware, orders for fittings not actually in stock must be accompanied with a Ministry of Munitions permit. There is, however, quite a demand for the less expensive fittings for Government works and offices. The company holds a fair stock of pre-war fixtures.

Spain.—One result of the war is likely to be the forcing of Spain into the ranks of producers of ferro-manganese. By a recent Anglo-Spanish agreement it was stipulated that this country should supply to Spain ferro-manganese to the extent of 120 tons per month, which was shared among the various producers of steel. Deliveries have been interrupted by the war, and in consequence some six electro-metallurgical companies have taken steps to produce the article themselves. The companies indicated are the Altos Hornos de Viscaya, the San Francisco del Desierto, the Fabrica de Mieres, the Altos Horno de Malaga, the Fabrica de la Senora Urigoitia in Araya, and the Metalurgica Duro-Felgueta. The last-named, it is stated, has acquired a large quantity of ore to treat in its furnaces.

Plant for Sale.—Oldham Corporation Electricity Department has for disposal two Willans-Siemens 740-KW. sets, shunt-wound, 450-480 volts. Particulars are given in our advertising pages to-day.

Liquidations.—Calmon Asbestos and Rubber Works, Ltd.—A petition, presented by the Board of Trade, for the winding up of the company, is to be heard on May 7th.

Prentice Wireless Train Control, Ltd.—A meeting is to be held on June 3rd, at 5, Broad Street Place, E.C. 2, to hear an account of the winding up from the liquidator, Mr. F. V. Royce.

Watson's Water Softeners, Ltd.—This company is winding up voluntarily, with Mr. G. H. L. Volans, 2, Albion Place, Leeds, as liquidator. Meeting of creditors held May 1st.

Book Notices.—*The Engineer's Year-Book for 1918.*—Edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood and Son. Price 25s. net.—It is given to very few men to establish a standard work of reference, to preside over its development, to witness its steady growth in popularity (and bulk !), and to see it attain its twenty-fifth birthday. Our hearty congratulations are, therefore, due to Mr. Kempe on the completion of a quarter of a century of existence by his well-known Year-Book, and on the undoubted success which could alone justify so remarkable a record. The original volume contained some 570 pages; the present issue has been expanded to no fewer than 2,098 pages, an increase of nearly 300 per cent., and contains about 2,000 illustrations. Further, the volume has been produced to all appearances in identically the same style as its predecessors, in spite of the immense difficulties that must have been experienced in achieving this result under war conditions, the severity of which can only be realised by those who come into contact with the printing world, and our congratulations are therefore extended also to the publishers. The contents have, as usual, been fully revised, and new sections have been added, including those on "Fuels: Solid, Liquid, and Gaseous," by Mr. H. Moore; "Mine Valuation," by Prof. H. Louis; "Metallurgy," by Mr. O. W. Ellis; and "Explosives," by Prof. W. R. Hodgkinson. Turning over the pages of this store of engineering information, one realises the impossibility of commenting on the contents of the 40-odd sections; fortunately, it is not necessary, for a work which has triumphantly withstood the fires of criticism for 25 years may confidently be relied upon as a trustworthy guide, and classed "A1."

"The Beama Journal." Volume IV, No. 2. April, 1918. London: King's House, Kingsway. Price 1s. net.

The "M. & C. Apprentices' Magazine" for April, like its forerunners, contains a number of interesting articles—a voyage on a Zeppelin (in 1910), several accounts of the M. and C. camp from different points of view, technical items, and an abundance of house news and notes—and maintains the high standard of excellence to which we have previously drawn attention.

"Post Office Electrical Engineers' Journal." Vol. XI, Part 1. April, 1918. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Scientific Industrial Efficiency." By D. T. Farnham. Brick and Clay Record, Chicago.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI, No. 273. April, 1918. This issue contains the following papers:—"Switchgear Standardisation," by Dr. C. C. Garrard; "Galileo and Magnetism: a Study in Loadstones," by Mr. J. J. Fahie; "The Evolution of the Thermionic Valve," by Mr. R. L. Smith-Rose; also the 15th list containing the names of 38 members on naval and military service.

"Annales des Postes, Télégraphes, et Téléphones." Paris: A. Dumas. Price 12 fr.

LIGHTING AND POWER NOTES.

Armagh.—The Urban Council has refused the Gas Co. permission to erect poles with a view to carrying out an electric lighting scheme, the view of the majority being that such a scheme should be a municipal one.

Australia.—Power Bill.—The Bill that is to be reintroduced before the Victorian Legislative Assembly this session, giving the Railway Commissioners power to install electric mains and distribute electric power, without restriction as to area, is exciting considerable opposition from the Melbourne City Council and the Melbourne Electric Supply Co. On behalf of the present distributors it is pointed out that it would be wasteful to have duplicated reticulations in the same areas, and that, in any case, since the electrified railways are estimated to absorb 48,000 KW. of the 50,000 KW. which the Newport plant is designed to produce, the competition of the Commissioners can only be in the nature of temporarily "picking out the eyes" of, say, the municipality's largest consumers, particularly future consumers. The right of the Commissioners to obtain some financial return from the Newport plant pending its complete utilisation by the railways is not disputed by other local authorities; but it is contended that this purpose can be most usefully and equitably served by Newport supplying its surplus power in bulk to the present local distributing agencies. The views of the various interested parties are at present being represented to the Government. It is somewhat significantly pointed out that if the Railway Commissioners had any earlier intention of catering for the public demand for electricity outside of the railways, they have hardly provided for it in the present plant, which, with its 25-cycle frequency, is not as suitable for power and lighting purposes as the 50-cycle frequency.

Melbourne Age.

Stawell B.C. (Vic.) has decided to confer with the Ararat (Vic.) B.C. on the question of a joint scheme to supply both municipalities with electricity generated by water power from the Grampians.

Hamilton T.C. (Queensland) has been notified by the City Electric Co. that the laying of the electric mains within the town would be commenced within three months from the date of the Order in Council and the formal consent to overhead construction. Electrical energy would be available in the town within a month from the commencement of the work.

Sydney City Council has decided (subject to a satisfactory agreement being signed for a period of five years) to give a supply of electrical energy up to the rate of 1,500 KW. to the Commonwealth Steel Products Co., the supply to be taken during May, June, July, and August in each year, at certain fixed hours, at the rate of ·65d. per unit; also, when the supply is available, to give energy, without restriction as to hours, at ·8d. per unit, the prices to be subject to a coal clause. The voltage of the supply is to be approximately 33,000, three-phase, 50 cycles, the demand not to exceed 1,500 KW., with a power factor of not less than ·85, the consumption per annum to be not less than 4,000,000 units. It is stated that the company is purchasing a site for the works on the banks of the Paramatta river.—*Tenders.*

Adelaide.—Price Reduction.—The Electric Supply Co. has reduced the charge for electricity for power between 10 p.m. and 8 p.m., for a consumption up to 5,000 KW. per month, to 1¼d. per unit; above this amount per month, ⅝d. per unit; the tariff is subject to a slight reduction with the price of coal. These rates are precisely half those ruling for similar consumption during the usual daylight hours.

According to a recent copy of *Tender* the Commonwealth Steel Products, Ltd., has purchased the Newcastle Brick and Tile Co.'s works at Waratah, N.S.W., for £13,500. In connection with an electric supply for the company, negotiations have been in progress between the company, the Railway Department, and the Newcastle city electrical engineer. The Railway Department has now notified the Newcastle Corporation that the Commissioners are prepared to take the necessary steps to provide for an additional load of 1,500 KW. within 12 months and of 2,000 KW. in 18 months, the conditions to be subject to the existing arrangement between the Council and the Railway Department.

Bexhill.—PRICE INCREASE.—The Corporation has decided to increase the price of electricity by 10 per cent., making an advance of 25 per cent. on pre-war rates. Prepayment meter rates will be raised from 1s. to 2s. 6d. per quarter.

Braintree.—PROV. ORDER.—The U.D.C. has received a communication from the B. of T. stating that until the reports of the two Parliamentary Committees were received the Board could not proceed with the application for a prov. order for electric lighting, and as those reports could not be received in time for the present session of Parliament, the matter would have to stand over for another year.—*Essex Weekly News.*

Continental.—FRANCE.—The Société des Forces Motrices de Vicors is establishing an electric generating station to utilise the water power of the River Doux at Saint Barthelemy (Ardoche). Four groups of 1,200-H.P. turbines, coupled to three-phase alternators working at 3,800 volts, 50 periods, are being provided for, some of these being already completed and at work. The current generated is stepped up to a pressure of 32,000-35,000 volts, and is transmitted to Tournon, about 4½ miles away.

SWEDEN.—Among the new electricity supply undertakings recently organised in Sweden are the Sodra Vattenkraft Aktiebolag, Jonhoping, to establish a hydro-electric station, and the Aktiebolag Malmtacks Electricitetsverk to establish a central station in the town of Malmtack.

Dublin.—Tuesday, April 23rd, was observed as a day of "Rest" by Irish labour generally, by way of demonstrating the authority of the Unions in a protest against the application of conscription to the country. As a result, most of the electrical works were closed down. In Dublin the Corporation, at the request of the Labour leaders, closed down the works from 6 a.m. to 6 p.m. The "Rest" did not affect Belfast or the north-east towns, where work proceeded as usual. In some towns in the east and south strong complaint was made as to the cutting-off of supplies.

East Ham.—PRICE INCREASE.—The charges for electrical energy subsequent to the meter readings of the June quarter, 1918, and of the tramway undertaking as from April 1st, 1918, are to be as follows:—Private supply: Fixed rate, 4d. per unit, plus 33⅓ per cent.; maximum demand, 5½d. per unit for the maximum demand for one hour per day for 92 days per quarter, and 2½d. per unit for all current in excess of this amount, plus 33⅓d. per cent. Contractors' rate: 2d. per unit, plus 33⅓d. per cent. Power and heating: 1¾d. per unit, plus 33⅓ per cent., for first 1,000 units per quarter; 1½d. per unit, plus 33⅓ per cent., subsequent consumption up to 6,000 units per quarter; 1¼d. per unit, plus 33⅓ per cent., 6,000 units and upwards per quarter. Outdoor signs: 2½d. per unit, plus 33⅓ per cent. Arc lamps: Special rates; charge to be increased by ½d. per lamp per hour, plus 33⅓ per cent. Any other special rates in force to be increased ½d. per unit, plus 33⅓ per cent. Minimum charge to be 3s. per meter per quarter, plus 33⅓ per cent., for private lighting and power supply and 12s. per annum, plus 33⅓ per cent., for heating supply. Traction supply: 1·0625d. per unit, plus 33⅓ per cent.

Edinburgh.—PRICE INCREASE.—The E.L. Committee has recommended that the charges for electricity to private consumers should be 3½d. per unit, an increase of ⅛d., and for power 1⅞d., plus 20 per cent., instead of 1⅝d., plus 10 per cent., as at present.

Glasgow.—STREET LIGHTING.—Arrangements are being made for drastic reductions in street lighting, which will amount to about 50 per cent., taking the city as a whole. Lighting will be graduated in accordance with the requirements of traffic; in busy thoroughfares lighting will be less restricted than in suburban districts.

Hornsey.—PRICE INCREASE.—The T.C. has decided from the reading of the meters in June next to make a minimum charge of 6s. 8d. for each of the two summer quarters, and of 13s. 4d. for each of the two winter quarters for electricity supplied.

Ilford.—PRICE INCREASE.—The Electricity Committee has recommended the following revised tariffs, to come into operation from the next reading of the meters:—For residential premises, Rate "A."—12½ per cent. per annum on rateable value, plus 1d. per unit. Both the above charges will be subject to an increase of 50 per cent. Rate "B."—For lighting, 6d. per unit; arc lamps, 5d. per unit. Rate "C."—Maximum demand system, 8d. and 3d. per unit. Rate "D."—Slot meters, 6½d. per unit. For power.—Rate "E" maximum demand system, 4d. and 2d. per unit. Rate "F."—First 500 units per quarter, 4d. per unit; next 1,000 units, 3d. per unit; next 1,000 units, 2½d. per unit; all over 2,500 units per quarter, 2½d. per unit; 10,000 units and over per quarter, 2¼d. per unit. For heating, &c., Rate "G." 2½d. per unit. Rates for special purposes: Kinemas, vehicle charging, photographic lamps, bulk supply, &c., 25 per cent. additional, making total increase 75 per cent. Minimum [illegible] per quarter net.

Kilmarnock.—ANNUAL REPORT.—The report of the year's working of the Corporation electricity department to May 15th, 1917, shows total revenue £33,809, working expenses £17,863, gross profit (including income-tax retained) £16,004, capital charges £9,379, net profit £6,625, as against a profit of £3,342 for 1915-16. From the net profit of £6,625 a sum of £1,000 has been repaid to the gas department on account of various sums advanced during the first few years of the undertaking, leaving a net balance of £5,625. Mr. Bexon, chief electrical engineer, states that during the year 8,373,517 units were sold as compared with 5,026,800 the previous year; the great increase is entirely due to the rapid development of the power load, of the full output 87·8 per cent. is for energy used by consumers under agreements varying in periods from five to 13 years. An increase of 1,693,696 units has been obtained from the Burgh of Kilmarnock, and from the outer burghs an increase of 1,653,021 units over the previous year. In the eastern area a large number of mills have been connected during the year, but, owing to Government restrictions, many of the remaining mills not employed on Government work which would have taken the supply have been unable to obtain the necessary motors and material. In the Irvine districts it can be safely stated that all the large works now take the supply from the department, and in the City Council area three coal pits have been electrified chiefly for pumping purposes during the year, and a number of farms have taken the supply for agricultural purposes. Total works costs per unit ·512d., as against ·585d., which is the same figure as was obtained for 1914-15. Average price of coal per ton in 1915 4s. 2d., 1916-17 10s. 10d. Load factor 29·60, as compared with 24·28; maximum load 3,250 KW., as against 2,400 KW.; 707 motors connected, with a total of 8,887 H.P.

Manchester.—RATE AID.—The Electricity Committee has been able to allocate £16,570 for rate aid, and also £1,996 for special expenditure for which borrowing powers were not obtainable, and to carry £6,469 to reserve fund. The departmental year closed with a surplus of £8,465, instead of a deficit of £10,570. During the coming year the rate aid, fixed by the Council at 1 per cent. on capital outlays, will absorb £33,400, or more than double last year's contribution.

Nelson.—YEAR'S WORKING.—There was a loss on the working of the electricity undertaking for the past year of £1,987.

Newcastle-on-Tyne.—A conference of representatives of municipalities in the North-East of England was held in Newcastle on April 26th, to consider the report of the Coal Conservation Sub-Committee, and it was discussed at length in private. The conference agreed that the manufacture of electrical energy for public utility purposes should be under public control. The following resolution was also adopted:—"That this conference, whilst recognising that the unification, production, and distribution of electrical energy over areas sufficiently large and carefully defined is desirable, does not endorse the recommendations in the report of the Coal Conservation Sub-Committee, and agrees to appoint a Committee to consider that report, and prepare a reasoned statement in relation thereto."

Shropshire Power Co.'s Bill.—The Shropshire, Worcestershire, and Staffordshire Bill was further considered by Lord Muir Mackenzie's Committee of the House of Lords last week. Mr. V. Knox, who appeared for the Corporation of Wolverhampton and Smethwick, asked for the insertion of a clause which provided that the Shropshire Co. should not, during the continuance of the present war, or for two years afterwards, exercise in the northern area, or any part thereof, any powers they possessed under the Act of 1913, or this Act, and that nothing contained in this Act should prejudice any application which might be made by a public body authorised by Parliament to supply electricity for the cesser or revocation of the company's power. Mr. Lloyd, for the company, said the clause would make the position of the Shropshire Co. impossible; it would exclude them from the whole county of Stafford and the greater part of the county of Worcester. One of the main objects of the Bill was to enable the promoters to link-up with Birmingham. Lord Muir Mackenzie said the Committee was of opinion that the Shropshire Co., pending the introduction of a great scheme for the supply of electric power in the district, should not be allowed to penetrate into the northern area. The decision would not affect any district where the Shropshire Co. were now supplying electricity.

At the resumed sitting, Mr. Charteris, on behalf of the promoters, said the parties had practically agreed upon a clause to carry out their Lordships' decision. The clause was substantially the same as was submitted by Mr. Knox, the only difference being in regard to a sub-section which provided that the company should not, except by direction of the Ministry of Munitions, with the consent of the Midland Electric Corporation for Power Distribution, or in the Boroughs of Walsall, Wolverhampton, and W. Bromwich, with the consent of the local authorities thereof respectively, during the continuation of the present war, and for two years thereafter, supply electricity in the area in the section defined, or in any part thereof, to any authority, company, or person not supplied by the company on April 25th, 1918.

The Committee agreed with the clause as handed in, and the Bill, having passed the Committee stage, was ordered to be reported to the House of Lords for third reading.

Rawtenstall.—Plant Extensions.—At the Corporation electricity works, a few days ago, the Mayor started a new turbo-alternator, which will increase the output from five million to seven million units, the total cost of the work being £9,760, which is being paid out of the revenue. The new installation raises the capacity of the Hareholme works from 4,400 H.P. to 7,500 H.P.

Rochdale.—Year's Working.—The result of the past year's working of the electricity department of the Corporation is a deficiency of £3,674, which, added to a debit balance of £6,036 brought forward, leaves a total deficit of £9,710. This amount is to be taken from the depreciation fund, which will now be reduced to less than £200. This proposal is being made to avoid an increase of 6d. in the rates, which, apart from this, are to go up from 9s. 6d. to 10s. 9d. The income of the electricity undertaking was £74,341, an increase of £12,306, whilst the working expenses (£54,302) were lower by £269. The gross profits were £20,038, an increase of £12,238. Interest and sinking-fund charges were £19,562, depreciation £2,495, and half wages and bonuses make up the difference.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Fare Revision.—The revised tramway fares on the Corporation electric tramways came into operation on Monday, last week. The first 1d. stages are, on the average, a mile and a quarter in length, and the other stages on the routes are shortened accordingly. The general effect is an increase of ½d. on the longer journeys. The Tramways Committee claims that, with the increased fares, Birmingham compares favourably with other cities and towns, some of which have adopted a minimum fare of 1½d., and have no overlapping stages. The Committee is not compelled under its statutory obligations to carry ordinary passengers more than a mile for 1d.; but there is a direction to carry workmen, at specified times, two miles for the 1d. fare. In view of the increased cost of running the tramway system, the City Council has asked the Board of Trade to consent to a removal of this obligation. Children's fares have also been revised—the minimum is 1d.

Bolton.—Rate Aid.—The Tramways Committee has decided to transfer £15,500 in aid of rates, the amount estimated at the beginning of the year, and has also agreed to estimate for a similar sum as profit in aid of rates for the year ending next March.

Bristol.—Strike.—The *Times* states that the tramway services were partly suspended, on Tuesday last week, by a strike involving the question of the employment of non-Unionists.

On April 26th the men resolved to resume work, pending negotiations between the Transport Workers' Federation and the company.

Burnley.—Fare Revision.—The Tramways Committee has decided to recommend the Town Council to adopt increases of tramway fares from June 1st. School children at present using discount tickets will be affected by the alterations, and a number of transfer tickets are to be abolished.

Cardiff.—Economy.—The Corporation Tramway Department appreciates the scarcity of paper. All scrap is returned to the firm supplying the tickets, while the sweepings of the cars are riddled, put in bags, and returned to the paper mills.

Continental.—Germany.—Three electric locomotives of a new type have recently been put in service for goods traffic on the Magdeburg-Leipzig-Halle section of the German State Railways. The machines are of 1,200 H.P., and are designed to work with alternating current at 13,500 volts, 16⅔ periods per second, each locomotive being equipped with a couple of motors. The locomotives were built by the Allgemeine Electricitäts Gesellschaft, Berlin, which has also 27 more of the same type in course of construction for goods train haulage.

The *Evening News* states that all the tramways and omnibuses in Budapest have ceased to run.

Cork.—Wages.—The Tramway Co.'s employés' wages demand has been settled by negotiation, thus averting a threatened strike.

Dublin.—Fare Increase.—A revised list of fares on the United Tramway Co.'s lines came into operation recently. Its effect generally is an increase of ½d. on the overlapping stages, which means that most of the 1d. stages are now 1½d., but some of the 1d. fares remain the same. Special through cars to outlying places have been withdrawn, as also have season tickets.

Wages.—Mr. J. H. Baillie, arbitrator in regard to the United Tramway Co.'s employés' application for a 20s. advance on pre-war rates, has decided on 5s. increase for men whose aggregate advances since the war do not exceed 15s. over pre-war rates, and an increase to produce 20s. over pre-war rates for men in the power-station, overhead department, and Ballsbridge works whose increases since the war are in excess of 15s. but less than 20s., the advances not to apply to traffic, motor, or ticket inspectors, timekeepers, tradesmen at Ballsbridge, the cable department, or workmen at the Inchicore works.

Halifax.—Wages.—The Tramways and Electricity Committee has appointed a Special Sub-Committee to consider the scale of pay, &c., now in force for inspectors, motormen. and conductors in the Tramways Department, and to report.

Heywood.—Year's Working.—The year's working of the Corporation tramways has resulted in a profit of £502, as compared with a loss of £783 for the previous year.

Kilmarnock.—Year's Working.—The report of the burgh tramway undertaking for the year ended May 15th, 1917, shows total revenue, £9,200; operating expenses, £8,048; gross profit, £1,152; after deducting sinking-fund and interest charges and allowing £1,160 for depreciation, there is a net deficit of £3,163, as against a deficit of £3,064 in 1915-16. Average total revenue per car-mile, 9·23d.; average operating expenses per car-mile, including power cost, 8·073d. Number of passengers carried, 2,483,155; car-mileage, 239,296—an increase of 71,068 passengers and a decrease of 36,053 miles.

Leeds.—Fare Revision.—It is announced that some misunderstanding has arisen in regard to the proposed revised tramway fares. The idea got abroad that ½d. fares were to be entirely abolished, but it is stated by the department that the end of the ½d. fare applies only on the existing first two ½d. stages from the centre of the city.

Leyton.—Electric Vans.—The U.D.C. is pressing upon the Government department concerned, as a matter of urgency, a request for authority to purchase two electric dust vans.

Liverpool.—Year's Working.—Compared with pre-war times, the traffic on the tramways during 1917, according to the manager's statement published on Monday, shows an increase of 40 million passengers. Causes are to be found in the diversions from railway traffic, munition workers, and the port's shipping activity. The year's revenue was £845,645, yielding a gross profit of £270,000, of which £125,000 goes to the relief of the rates.

London.—L.U.T.—According to the *Evening News*, the proposal to abandon portions of the London United Tramway system has been dropped.

Manchester.—Fare Increase.—The Tramways Committee has decided to ask the City Council for leave to revise the passenger fares as follows:—Halfpenny stages on circular and other routes to be abolished, and the minimum fares on such routes to be 1d.; workmen's fares to be abolished on all routes, and every class of passenger called upon to pay ordinary fares; a new scale to be adopted of approximately two miles for 1d. from the centre of the city; corresponding increase as regards 1½d., 2d., and higher fares and stages; fares of children up to 14 years of age to remain as at present, namely, half fares. The statutory requirement is to carry workpeople two miles for 1d., whereas at present in Manchester the workpeople's stages average about 3½ miles for 1d. The Committee state that it is compelled to make these changes because of the City Council's demand for a contribution of £111,890 in aid of the rates, and the several heavy charges in respect of war bonuses, service allowances, &c., amounting in the aggregate to £319,745.

Nelson.—Year's Working.—The light railway undertaking shows a net profit on the year of £615.

Northampton.—Sunday Service.—The Tramways Committee has decided to cease running tramway-cars on Sundays, and to stop them half-an-hour earlier on week-days.

Preston.—Purchase of Cars.—The Town Council has adopted the recommendation of the Tramways Committee to purchase six additional single-decked cars from the Sheffield Corporation, at a cost of £350 each. Alderman Ormrod stated that there was a big increase in traffic, over 44,000 more passengers being carried the other week, as compared with the corresponding period of last year, and the new cars would be of very great service.

Southend.—Fare Increase.—The *Evening News* says that, commencing May 1st, all fares on the Corporation tramways will be increased by 75 per cent.

Tramway Charges.—Last week the House of Commons appointed a Select Committee to consider and report whether it is expedient that some provision should be made for the temporary modification of statutory requirements with regard to the charges for the conveyance of traffic on tramways and light railways constructed wholly, or mainly, on public roads, in the case of undertakings whose financial circumstances have been injuriously affected by causes arising out of the war. The following are the names of the members of the Committee:—Capt. Barnett, Sir J. Boyton, Mr. Broughton, Mr. Cochrane, Sir A. Fell, Mr. Nugent, Sir W. Pearce, Mr. Rendall, Mr. Tootill, and Mr. Watt.

Whitley and Monkseaton.—At a meeting of the District Council it was stated that the Tynemouth Corporation was considering the question of the local tramways in view of the fact that the lease with the present company was approaching its termination, and a joint conference was suggested. It was decided that the Tynemouth Corporation be asked to meet the District Council in Committee.

TELEGRAPH AND TELEPHONE NOTES.

Delivery of Telegrams.—Notice is given in the *London Gazette* of the issue of regulations relating to special instructions as to the delivery of telegrams, which come into force on June 1st, 1918.

South America.—The Brazilian Government has authorised the Western Union Telegraph Co. to lay two cables from Rio de Janeiro to other Brazilian ports. One is to extend northward to Belem or Para, which is located on the Para River, 80 miles from the Atlantic Ocean. This cable will be approximately 3,500 miles in length. The other line will extend from Rio to Paranaqua, a maritime town about 650 miles down the coast. It is expected that the Rio-Belem cable will be extended to the Antilles.

The extension of cable landing rights to the Western Union Telegraph Co. has been a subject of negotiation for several months between the company and the Brazilian Government. These rights heretofore have been held exclusively by British companies. As it is impossible to obtain cable either in the United States or abroad, actual construction of the two new lines probably will not be begun until after the war.—*T. and T. Age.*

United States.—The main purpose of the Pan-American Wireless Telegraph and Telephone Co., which was organised in New York recently, is to connect the United States with all the countries of South and Central America, and the West Indian Islands, by wireless telegraphy. It will begin with Argentina, where the arrangements with the Government have been concluded, and its technical experts are arranging for suitable sites, so that the high-power stations and their necessary equipment can be completed and ready for service within the next 12 months. The work will afterwards be taken up in Brazil, and then in the other States successively, and as rapidly as the necessary arrangements can be made. Mexico will be included in the system. Wireless stations, more powerful and complete than any heretofore constructed, will be erected in each of the principal trade centres of the various countries. and will be able to carry on a 24-hour commercial telegraph service with New York. Messages intended for Europe will be sent either directly or through the trans-Atlantic wireless service of the Marconi Wireless Telegraph Co. of America, making connections with Great Britain, France, Spain, Italy, Russia and Scandinavia; and, from the Pacific Coast—San Francisco, Cal.—wireless connections will be made, through Hawaii, with Japan and the Orient. In the United States the system will connect with the land lines of the Western Union Telegraph Co. This greatly improved service will be accompanied by a substantial reduction of rates.

The fulfilment of this comprehensive programme will be greatly facilitated by the adoption of the latest inventions in wireless telegraphy, including the patents and improvements of the American and English Marconi Companies and the Danish Poulsen-Pedersen system. The new company is in a very strong financial position, with abundant resources for the carrying-out of its great undertaking. No stock is offered for sale. The president, Mr. Edward J. Nally, is also vice-president and general manager of the Marconi Wireless Telegraph Co. of America.

The Western Union Telegraph Co., at the end of 1917, had 199,473 miles of pole line. 1,599,377 miles of wire, 2,875 miles of land line cables, and 22,915 n. miles of ocean cables, with 25,166 offices in operation. The traffic was unprecedented, showing an increase of 66 per cent. over 1914.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Brisbane.—July. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary, the Treasury, Brisbane.

Glasgow.—May 7th. Cleansing Department. Six months' supply of electrical material. Mr. W. Greig, Superintendent, 20, Trongate.

Hoylake and West Kirby.—May 11th. Supply, &c., for one year to March 31st, 1919, of metallic filament lamps. Particulars from R. Williams, Clerk to Council, Town Hall, Hoylake.

Leith.—May 6th. Electricity Committee. Six or 12 months' supply (9,000 and 18,000 tons) of washed singles. Burgh Electrical Engineer.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

H.M. Office of Works. May 10th. Supply of main switches. See "Official Notices" to-day.

Redditch.—May 13th. U.D.C. Turbo-alternator, cooling tower, switchgear, water-tube boiler, &c. See "Official Notices," April 26th.

Spain.—Municipal authorities of Villarramiel (Province of Palencia). Tenders for the concession for the electric lighting of the town during 15 years.

Warrington.—May 22nd. Electricity and Tramways Committee. Motors and transformers. See "Official Notices" to-day.

CLOSED.

Ilford.—U.D.C. Fuller Wire & Cable Co., Ltd. 150 yd. 61/12, 600-volt cable. £125.

Spain.—La Sociedad Energia Electrica de Cataluna has recently placed a contract with Messrs. Escher, Wyss & Co., of Zurich, for three Pelton turbines for its new hydro-electric station near Capdella, in the Pyrenees. Each of the turbines will be of 6,700 h.p., when running at a speed of 375 revs. per minute.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 3rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on the paper "Employment of Women in Munition Factories."

Junior Institution of Engineers.—Friday, May 3rd. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Power Plants: National, Communal, or Industrial," by Mr. W. A. Tookey.

Saturday, May 11th. At 3 p.m. At the Holborn Restaurant (Venetian Chamber). Annual Bohemian Concert.

(**North-Eastern Section.**)—Tuesday, May 7th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "Critical Speeds of Shafts," by Mr. G. Bonner.

Association of Mining Electrical Engineers (West of Scotland Branch).—Monday, May 6th. At 4.30 p.m. At the Royal Technical College, George Street, Glasgow. Paper on "Organisation of Electrical Repairs," by Mr. J. McCann. Annual meeting.

Roentgen Society.—Tuesday, May 7th. At 7.45 p.m. At the Royal Society of Arts. General meeting.

Faraday Society.—Tuesday, May 7th. At 5.30 p.m. At Burlington House, Piccadilly, W. 1. Discussion on "The Co-ordination of Scientific Publication," to be opened by Sir Robert Hadfield, F.R.S.

Salford Technical and Engineering Association.—Wednesday, May 8th. At 7 p.m. Visit to Messrs. Mitchell, Shackleton & Co., Ltd., Vulcan Works, Patricroft.

Institution of Electrical Engineers.—Thursday, May 9th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on "A British Electrical Proving House," with an introductory paper by Mr. C. Turnbull.

(**Newcastle Local Section**).—Monday, May 6th. At 6.45 p.m. At the Mining Institute. Informal discussion on "The Proposed Regulations for the Electrical Equipment of Ships," to be opened by Mr. A. P. Pyne.

(**Scottish Local Section**).—Tuesday, May 7th. At 7.30 p.m. At 207, Bath Street, Glasgow. Informal discussion on "The Proposed Regulations for Electrical Equipment of Ships," to be opened by Mr. J. F. Nielson.

Electrical Power Engineers' Association (Midland Section).—Friday, May 10th. At the Imperial Hotel, Temple Street, Birmingham. At 7.30 p.m. Smoking Concert.

London Association of Foremen Engineers.—Saturday, May 11th. At 6 p.m. At Cannon Street Hotel, E.C. Sixty-fifth Anniversary Festival.

NOTES.

The Lochaber Water Power Bill.—In the House of Lords, on Tuesday, Lord Balfour moved the rejection of the British Aluminium Co. (Lochaber Water Power) Bill. After discussion, the motion for the second reading of the Bill was by leave withdrawn.

Wages Award.—The Committee on Production, to which the Ministry of Labour referred a claim by the staff employés of the General Electric Co., Ltd., Witton, for payment of the 12½ per cent. bonus on earnings, has issued an award in favour of the employés. The Committee's decision is that having regard to the cases in which the sanction of the Ministry of Munitions has been given to the grant of the bonus of 12½ per cent. on earnings to members of clerical staffs, a bonus of that amount shall be given to men concerned in this claim, to date as from the beginning of the first full pay-day following the date of the award, such bonus to be limited to £31 5s. per annum—viz., 12½ per cent. on the first £250.

London (E.T.U.) Station Engineers' Concert.—The first annual concert of the London Station Engineers' Branches of the Electrical Trades Union was held on April 24th at the Horns, when a first-class programme was produced. We are informed that the hall was packed with representatives of all branches of the trade. During the evening a presentation of a bureau, bookcase, and an illuminated address was made to Mr. H. H. Morton, secretary of No. 1 Branch, for his strenuous and successful efforts to ameliorate the position and improve the status of the station engineer. The president observed that, whereas in November, 1916, only one branch had been formed in London, to-day eight other branches were necessary to cope with the increasing membership. Mr. Morton, in replying, thanked the members for the handsome appreciation of his efforts, and hoped the day was not far off when the present division amongst station men would disappear, as the outcome of mutual toleration, when he anticipated that a common basis for united effort would be found. The concert arrangements were in the hands of Mr. Belcher.

British Scientific Products Exhibition.—The British Science Guild is organising a comprehensive exhibition of products and appliances of scientific and industrial interest which, prior to the war, were obtained chiefly from enemy countries but are now produced in the United Kingdom. The Exhibition will be held at King's College London for four weeks during the coming summer.

It will probably come as a considerable surprise to the public to know how much has been accomplished here since the war in industries in which previously we had been falling behind; and it is believed that the Exhibition will have a most stimulating influence upon scientific and industrial research by bringing home to manufacturers, as well as to the public, the supreme importance of science in industry.

Particulars of the Exhibition will be issued shortly. The organising secretary is Mr. F. S. Spiers, 82, Victoria Street, S.W.

Brighton Electricity Works Award.—The following is a copy of the award of the Committee on Production in respect of the employés of the Brighton Corporation electricity department:—

1. The parties to this reference are (1) the Brighton Corporation and (2) the Electrical Power Engineers' Association.

2. The claim is submitted on behalf of the technical staff of the electricity undertaking controlled by the Corporation for (1) the award of the Committee on Production of 15s. per week dating from August 1st, 1917; (2) the further award of the Committee on Production of 5s. per week dating from the first full pay day after December 1st, 1917.

3. The matter was referred by the Ministry of Labour to the Committee on Production for settlement. Representatives of the parties were heard on April 12th, 1918.

4. The award of the Committee is that the men concerned aged 18 years and over shall receive as from the beginning of the first full pay following April 12th, 1918, 20s. per week over their pre-war wages, all previous war wages or war bonuses (exclusive of service increments, advances for individual merit, and the bonus of 12½ per cent.) which have been granted since the outbreak of war being merged in the said 20s. per week.

5. The amounts hereby awarded are to be taken into account in the calculation of payment for overtime, or for work on Sundays or holidays, and are to be regarded as war wage advances and recognised as due to and dependent on the existence of the abnormal conditions now prevailing in consequence of the war.

George S. Gibb.
Geo. J. Rowe.
J. Duncan Elliot.

H. J. Wilson, Secretary,
5, Old Palace Yard, S.W. 1, *April 22nd*, 1918.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual general meeting will be held at the hall of the Institution of Civil Engineers, on May 30th, at 6 p.m., to receive and consider the accounts for 1917, and the annual report of the Council, and to elect auditors. The accounts and report will be printed in the number of the *Journal* to be published about May 21st (No. 274).

Further nominations have been received for the election of Council, namely:—Vice-President, Mr. S. L. Pearce. Ordinary member, Mr. E. B. Wedmore. The ballot papers have been issued, and are to be returned by May 8th.

Institution of Engineers and Shipbuilders in Scotland.—In the course of a paper on "Electrical Ship Propulsion," Mr. W. B. Hird pointed out that all who had worked at the question of electrical propulsion for any but quite small boats had turned to alternating-current apparatus, and usually to three-phase current, for effecting their purpose. The late Mr. Henry Mavor first proposed the changing of the periodicity of supply, which for marine propulsion had many advantages, and he hoped that the system associated with the name of Mr. Mavor and the Clyde would yet be given an opportunity of demonstrating its capabilities on a large scale.

Chief Technical Assistants' Association.—At a meeting held at Anderton's Hotel, E.C., yesterday evening, time permitting, the discussion on "Motor Converter *v.* Motor Generator" was to be resumed.

Liverpool Engineering Society.—On April 24th, Mr. R. Croston read a short paper on "The Micro-Photography of Metals"—evidently a slip for "Photomicrography," as the author uses the correct expression in the body of the paper—in which he gave brief particulars of the methods employed. In these days, when an engineer has to be conversant with so many chemical and physical tests and processes, such papers are of great utility.

Societe Internationale des Electriciens.—The annual general meeting was held on April 4th. M. Lucien Poincaré had been nominated in 1914 for the presidency, but having in the meantime accepted a position which would have clashed with this, he preferred to stand aside, and was unanimously elected honorary president. M. A. Larnaude was elected president for 1918-19, and M. X. Devaux-Charbonnel, Engineer-in-Chief of Telegraphs, president for 1919-20.

The Training of Disabled Fighting Men.—At a special meeting, last week, the Bradford Branch of the Electrical Trades Union received representatives of the local War Pensions Committee, the Technical College, the Discharged Soldiers' and Sailors' Federation, and the local electrical contractors, to confer on proposals for the training of disabled men for certain branches of the electrical trades. The meeting was under the chairmanship of the Deputy Lord Mayor (Alderman Squire Deighton). Rules for the guidance of a Joint Committee to carry out a scheme were considered, and, when finally approved by all parties concerned, will be submitted to the Ministry of Pensions. The scheme provides for the training and employment of about forty disabled ex-soldiers and ex-sailors. During 12 months' training, it is proposed that they shall spend half time each week at the Technical College and half time at a workshop.

Under the new Royal Warrant which came into operation on Wednesday last, men who undergo training, and who already may receive a bonus of 5s. a week covering the period of training, may in addition, receive a further grant, not exceeding £10, for the purchase of tools, if those are required to be provided by the man in the trade in which he has been trained.

The Minister of Pensions has been informed that in certain instances sailors and soldiers who have been discharged for medical unfitness are unwilling to undertake regular work or to earn the highest wages they are capable of earning, because they fear that if they do so their pensions will be reduced.

It cannot be too widely known, he states, that disablement or minimum pensions are based solely on the degree of physical disability, and are not in any circumstances affected by the actual earnings of the men. So precise have been the intentions of the Ministry of Pensions in this matter, that instructions have been issued to the Medical Boards definitely forbidding the questioning of men regarding their earnings. The pension class of each man is established upon the degree of physical incapacity ascertained by medical examination. When it has been decided that no further improvement in the man's health may be expected his temporary pension becomes permanent and inviolate. It cannot be reduced, but if the condition of ill-health becomes worse it may be increased. Many permanent pensions have already been increased on that ground. Unwillingness to use one's working capacity to the full brings no advantage to the individual. On the contrary, an ample use of that capacity is not only a source of benefit to the man himself but must be regarded as a contribution to national efficiency.

By a slip, the name of the author of the article on page 429—Mr. C. W. Marshall, of Glasgow Corporation electricity department—was omitted.

Appointments Vacant.—Temporary clerk for the Rhondda U.D.C. electricity department; shift engineer for the Wellingborough Electric Supply Co., Ltd.; engineer-in-charge (£175) for the Worcester Corporation electricity works; fitter for the Borough of Burton-on-Trent electricity department; shift engineer (60s. + 8s. + 12½ per cent.) for the Borough of Swindon electricity department; two switchboard attendants (32s. + 20s. + 12½ per cent.) for the Burnley Corporation electricity works; shift engineer (60s. + 12½ per cent.) for the Radcliffe U.D.C. electricity department; engineer-in-charge (60s.) for oil-driven power station in the Northern Command; instructor in electrical work for the Sheffield Naval and Military War Pensions Committee; boiler house foreman (£200) for the Sunderland Corporation electricity works; shift engineer (60s. + 12½ per cent.) for the Eccles Corporation electricity department; improver as shift engineer for the Tonbridge U.D.C. electricity works; charge engineer for the Dover Corporation electricity department; meter inspector, installation inspector and tester, draughtsman (junior), fireman, switchboard attendants, and sub-station attendants, for the Greenock Corporation electricity department. See "Official Notices" to-day.

The Peace-time Activities of Vickers, Ltd.—A very interesting speech was delivered by Mr. Douglas Vickers at the annual meeting of the company, held at Sheffield last week, in which he told of certain important measures which the company is preparing for turning over from war-time to peace-time industries. We shall refer to the matter more fully in a later issue, but, according to a report in a Sheffield paper, we understand that the company had long intended to increase its electrical department in Sheffield, and had proposed to build new works on a large scale, probably outside Sheffield. Instead thereof, the directors have recently accepted an offer to be associated with the Metropolitan Carriage, Wagon and Finance Co. in the control of the British Westinghouse Co. This is thought to present much better prospects than building new works which would take a long time to get into working order. Electrical manufacturing will continue on much the same lines as before at Sheffield, but with a greater amount of specialisation.

The Apprehensive Rathenau.—During the war we have printed extracts from several interesting speeches delivered by Dr. Walter Rathenau. Whether he is still talking about preparations for the next war we do not positively know, but we think not. What he is now concerned about, according to the *Westminster Gazette*, is what is going to happen inside Germany after *this* war comes to an end. He is telling his countrymen very plainly that they must not expect the present period of brisk trade to continue. "Never was labour so fully employed as at present, he points out, never were wages so high or profits so big. But public opinion does not realise that all this prosperity emanates from one source—the State—which has to find the money for high wages and high profits by imposing heavy taxation. Dr. Rathenau foresees great difficulties in dealing with the mass of labour that will be thrown on the market after the war. Even if demobilisation is delayed, there will still be a vast surplus of labour, while production will be checked. Hence Germany will be faced with unemployment on a large scale, while at the same time the cost of living will not decrease. 'Gigantic tasks and enormous difficulties'—such is the gloomy language which Dr. Rathenau is driven to use in looking forward to the transition period after the war."

Fish Feeding by Electric Light.—The use of an electric light to catch fish is no new idea, but to feed them ——! A Kansas State hatchery has installed electric lights above the fish ponds, with the result that large numbers of insects are attracted to the vicinity at night. Eventually many of these fall into the water and are fed upon by the fish. The cost of food for the finny creatures has been about $1,000 a year, but under the present arrangement this expense will be reduced.—*Journal of Electricity.*

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square. W. 1.

Orders for the week ending May 12th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Captain W. Hynam.

Monday, May 6th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, May 7th.—Lecture on "Demolitions," at 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 8th.—No. 1 Company, Drill, Knotting and Lashing, 6.30—8.30. Recruits' Drill, 6.30.

Thursday, May 9th.—No. 2 Company, Drill, Knotting and Lashing 6—8. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30.

Friday, May 10th. Musketry, 5.30—8.

Saturday, May 11th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

Sunday, May 12th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Marching Order, with rifles. Mid-day and tea rations to be carried.

Special Notice.—All drills will take place at headquarters unless otherwise stated.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

The Whitley Report.—It is stated that the Admiralty have practically accepted the Whitley Report, and that it will be put into force in the Royal Dockyards, giving the workmen voice in the conditions under which they work, and in fixing the remuneration for their labour.

The Provincial Electric Supply Committee.—The annual meeting of this Committee was held on Tuesday, April 30th, at the Holborn Restaurant. The chairman, Mr. H. B. Renwick, presided, and the following representatives were present :—

Sir Henry Mance (Oxford Co.), Sir J. S. Harmood-Banner, M.P. (Midland Co.), W. L. Madgen (British Electrical Federation), F. E. Gripper (Edmundson's), Emile Garcke, A. A. C. Swinton (Cambridge Co.), J. E. Spagnoletti (Banbury Co.), J. G. B. Stone (Electric S. Corporation), G. H. Jackson (Northampton Co.), J. Herbert Edwards (Stroud, &c.), Talfoud Ely and J. J. Jeffery (Ross Co.), C. Shirreff Hilton (Birkdale Co.), H. B. Harvey (Kent Co.), K. A. Scott-Moncrieff (Hendon Co.), W. B. Esson (West London and Provincial Co.), G. W. Spencer Hawes (Reading Co.), H. B. Leather (Minehead Co.), John Christy and Leonard Christy (Clevedon Co.), Napier Prentice (Suffolk Co.), F. W. Reynolds (Coatbridge Co.), H. A. Alger (Richmond Co.), F. C. McQuown (Bournemouth Co.), H. W. Bowden (Woking Co.), J. L. Shand (Newcastle Co.), T. Petersen (Uxbridge Co.). Mr. Renwick, in opening the meeting, said that letters of regret at absence had been received from various members unable to be present. He went on to explain that the Committee was started at the beginning of 1917, and from an original number of 61 the total at the present day numbered 106 companies as members of the Association ; in fact, practically the whole of the important provincial supply companies throughout the kingdom. The Association grew out of the co-operation of the provincial companies under the appeal made by Mr. Renwick to the Excess Profits Commissioners, which resulted in the provincial companies being placed on a very favourable footing. The chairman, in reviewing the work of the year, ran over the various matters which had chiefly occupied the Committee's attention, including the Amendments to the Courts (Emergency Powers) Bill, by which clauses protecting water, heat, light, traction, and power were inserted ; the evidence given by the chairman on behalf of the provincial companies before the Board of Trade Electric Power Supply Committee ; negotiation with the Inland Revenue Authorities with regard to increased depreciation, local rating, leaving certificates, wages and bonus orders, and other matters ; also the conference with the Board of Trade to obtain increases in the maximum prices scheduled in Provincial Orders and with the same Department and the Ministry of Munitions, whereby support had been given to the companies in their revision of unremunerative long-term contracts. The position of companies using fuel oil had also been protected through the Petrol Controller of the Ministry of Munitions. Electric vehicles had received consideration, and the Committee were co-operating with the Institution of Electrical Engineers in regard to electric cooking. The Committee had also taken an important part in connection with the revision of the Reserved Occupations List and in connection with the Ministry of National Service. At the present moment the question of coal supplies and economies was the chief matter being dealt with. Sir J. S. Harmood-Banner, M.P., said that the result of the year's work were quite sufficient to show that they had acted wisely in creating this Association and supporting Mr. Renwick in his inauguration of the Committee, and although there were anxious times ahead, the companies' interests, in Mr. Renwick's hands, would be well looked after, and everyone felt they were under very good guidance. Sir Henry C. Mance expressed his appreciation of the assistance rendered to him by the Committee during the past year, and he urged the need for close co-operation and co-ordination of interests. Mr. Emile Garcke referred to the great success Mr. Renwick had achieved in bringing together such a representative body and the excellent work done during the first year. Mr. Madgen said he must emphasise the extremely useful and quite exceptional work put in and the practical management of the Committee, and he also emphasised the need for constructive co-operation, in view of the possibility of after-the-war demands. Mr. Campbell Swinton and Mr. F. E. Gripper also spoke on the work done during the past year. Mr. Renwick, in reply, explained that the very successful results which they had obtained must be taken as due largely to the assiduous work put in by the Executive Committee, without whose assistance he would not have been able to place such an excellent report before the members.

E.P.E.A. Concert.—The Electrical Power Engineers' Association (Midland Section) is holding a smoking concert at the Imperial Hotel, Temple Street, Birmingham, on Friday, May 10th. The chair will be taken at 7.30 p.m. by Mr. R. A. Chattock, M.I.E.E., the city electrical engineer of Birmingham. A large attendance is expected, and all engineers interested in the movement will be cordially welcomed. We learn that the Association is making excellent progress, and there is a steady influx of new members.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Tramways Committee is asking the Manchester Corporation to enter into an agreement with Mr. J. M. M'Elroy, the general manager of the tramways, under which he will undertake to remain in that position for five years, from May this year, at a salary of £1,500 per annum.

General.—Mr. J. Snow Huddleston has resigned his position with Messrs. Siemens Bros. & Co., Ltd., and has been appointed general manager of the Union Cable Co., Ltd., of Dagenham Dock.

Ald. J. M. Grey has resigned the chairmanship of the Electricity Committee of Burnley Corporation, which he has held for many years. The new chairman is Coun. Holden.

The many friends of the late Mr. J. M. Ralph will be interested to hear that a memorial is being organised to perpetuate his work in connection with the British Thomson-Houston Co. Funds have come readily to hand, but, due to the exigencies of the times, a number of letters have failed to reach their objectives. Will any old friends who are interested and have not received a notification kindly communicate with Mr. R. G. Hosking, 3, Bilton Road, Rugby?

Mr. W. H. Wilson has been appointed secretary of the London Electric Supply Corporation, Ltd., in succession to Mr. H. C. Carter, who has retired owing to ill-health. Mr. Wilson has been connected with the company since the early part of 1906.

Roll of Honour.—Captain H. E. Turner, who has been killed in action, was mains superintendent to the Hull Corporation electricity department. Only recently he had been decorated by the King of the Belgians for valour on the field.

Private A. Matthews, Lincolnshire Regiment, reported to be a prisoner of war, was an apprentice with Mr. J. E. Dyson, electrical engineer, Huddersfield.

Private A. E. Nixon, Dorset Regiment, killed in action, was the manager of the Electrical General Supply Stores, Leeds.

Private A. Mell, Worcestershire Regiment, reported missing, was an apprentice with Messrs. Flather & Co., electrical engineers, Leeds.

Signaller W. Briggs, W.R. Regiment, killed in action, was an electrical engineer at Eshton Hall, near Skipton.

Private S. Mairs, Cheshire Regiment, who is a prisoner of war in Germany, was employed by Messrs. Baxendale & Co., Ltd., Manchester.

Private H. Stringer, S. Lancashire Regiment, wounded, was employed by the St. Helens Cable & Rubber Co., Ltd.

Sergeant E. Wright, Machine Gun Corps, who was accidentally killed on April 19th, was formerly employed by the Peel-Conner Telephone Works, Ltd., Salford.

Mr. J. H. Atkinson, head of the carbon lamp department, B.T.H. Co., Rugby, has received news that his son, Corporal J. N. Atkinson, Machine Gun Corps, is wounded, and missing since April 12th. He was an apprentice at the Rugby works.

Sergeant W. Partington, West Lancs. R.F.A., who has been killed in action, was employed by Messrs. Dick, Kerr and Co., Preston. Gunner H. Crozier, R.F.A., employed by the same firm, has also been killed in action.

We desire to tender our sincere sympathy to Mr. and Mrs. E. Raymond-Barker, of Bisley, Gloucestershire, on the death of their son, Major R. Raymond-Barker, M.C., R.A.F., who was killed on April 20th in air action, aged 23.

Captain Michael Chapman, M.C., Grenadier Guards, who was killed on April 12th, was educated at Eton and Oxford, and, according to the *Times*, having qualified as an electrical engineer, he went out to Canada, and in 1906 he was for a short time on the staff of the late Lord Grey, before he eventually established an engineering business in Toronto. He was a son of Sir Arthur Chapman.

Second-Lieutenant C. N. Madeley, R.A.F., who died during an air fight on January 19th, was with the Westinghouse Co. at Manchester.

Sapper J. H. Wainwright, who was a master at the North Eastern School of Wireless Telegraphy, Leeds, is a prisoner of war in Germany.

At the presentation of medals and honours for bravery to munition workers and others at Leeds, last week, by the Earl of Harewood, Lord-Lieutenant of the West Riding, Mrs. Lily, of Leeds, received the medal of the Order of the British Empire. Employed as a driver of an electrical overhead crane at an ordnance factory, she saved a workman who became pinned between a pillar and a wheel of the moving crane by her gallantry in holding control to the stopping lever whilst the man was released, despite the fact that the sudden stoppage had caused a wheel to jump the line, and the whole crane, with her in it, was in momentary danger of collapsing. At the same investiture two Bradford telephone girls and a man telephone operator from the same city received medals under the Order, for gallantry in sticking to their posts, and thereby bringing up fire brigades, ambulances, doctors, nurses, &c., to a munition works which adjoined their exchange, and at which explosions were occurring at short intervals.

Lieutenant Harold Fisher, London Scottish, who was on the electrical staff at Hafod Colliery, has died of wounds.

Sapper Bird, R.E., who was prior to the war on the staff of Mr. Hall, borough electrical engineer at Burton-on-Trent, reported missing on March 21st, is a prisoner of war.

Private W. Johnson, K.O. Yorkshire Regiment, killed in action, was an electrical engineer, employed at various times by Messrs. Johnson & Phillips, Ltd., and Messrs. Bruce Pebbles & Co., and at Portsmouth Dockyard.

The death in action is reported of Second-Lieutenant Thomas Silver, a member of the Tramways Committee of the Birmingham City Council.

Rifleman W. J. Bridge, eldest son of Mr. Albert Bridge, commercial editor of the Electrical Review, is officially reported "missing" since March 23rd. Correspondence shows that he was wounded and, with many others, had to be left behind.

Rifleman R. Scarlett, 8th, K.R.R., who was condenser attendant at the Grove Road power station of the Central Electric Supply Co., is a prisoner of war in Germany.

Second-Lieutenant G. Gibbens, Middlesex Regiment, head storekeeper at Grove Road power station of the Central Electric Supply Co., was killed in action in France on April 2nd.

Corporal W. H. Barker, London Regiment, formerly in the general office of the India-Rubber Co., Silvertown, has been wounded in France.

Lance-Corporal W. Bain, M.G.C., who was in the proofing department of the India-Rubber Co., is now a prisoner in Germany. He joined up in 1914 and went to France, but on discovering that he was only 16 years of age the authorities sent him home. On attaining the age of 18 he rejoined, and went out again.

Obituary.—The *Times* of yesterday says that a Berlin telegram to the *Kölnische Volkszeitung* reports the death of Herr Arnold von Siemens, member of the Prussian Upper House, and chairman of the board of directors of Siemens and Halske.

Mr. J. W. Rook.—We regret to learn, as we go to press, of the sudden death of Mr. Rook, the managing director of the Sloan Electrical Co., Ltd.

CITY NOTES.

British Electric Transformer Co., Ltd.

The annual meeting was held on Tuesday at Salisbury House, E.C. Mr. A. F. Berry, who presided, said that the gross profit on the trading showed an increase of about £4,600, while the net profit was nearly £1,400 more than last year. The directors recommended that a further £7,500 be placed to reserve, bringing that fund up to about £52,000, which had been built up almost entirely out of profits. The depreciation reserve, with the £1,500 to be added, would stand at £15,300, which represented about 25 per cent. of the value of the two assets in the balance sheet against which it was built up. The ordinary shareholders were to be congratulated on the resumption of payment of the 10 per cent. dividend which they enjoyed for three years prior to the outbreak of war. During the past three years they had retained in the business some £7,000 by reducing the rate of dividend to 7½ per cent. That retained money had been most useful in the business, and had helped to carry out the volume of orders, one result being that they were now able to pay 10 per cent. dividend again. He did not say that they considered 10 per cent. a full and sufficient "peace-time" distribution on ordinary shares, and, although no one could say what the immediate future held for them, he personally hoped the time would come when they would do much better. He might mention that they started the current year with about 90 per cent. more work in hand in money value than they did the year 1917, although some of it was work they would not deal with for a long time. The question of finding new money to carry out the increased amount of work they had received became very pressing during the latter part of the year. In view of all the circumstances, they felt it desirable to issue the remainder of their shares, and he was pleased to be able to inform them that, having obtained the Treasury sanction to the issue, they had now been able to place all the remaining unissued shares of the company. Certain friends of theirs in the City thoroughly examined the works, and discussed the prospects of the company with himself and his colleagues some time ago, and before the excellent figures now before them were available. They were so impressed with the soundness of the company and the possibilities of expansion after the war that they made them a bid for the shares, and the directors felt it advisable, in view of present conditions, to accept the bid without waiting to offer the shares to the shareholders. At the same time they wished to retain for their old shareholders an opportunity of participating in the further issue of capital. They had therefore arranged with their friends that they should give existing shareholders an opportunity of taking up a portion of the shares in question, and he was pleased to be able to say that the buyers readily consented to do this. Each shareholder could, therefore, obtain further shares within the limits of the issue in the following ratio, three preference shares at 17s. each to one ordinary share at 18s. 6d. per share, and this offer would remain open until May 6th. Having spoken in terms of warm appreciation of the splendid effort that had been made by the employés of the company in helping to "carry on" ever since the outbreak of war, and referred with pride to those serving their country at the Front, he said that the work that had been accomplished in the past in their two special lines had for a long time past been increasingly great, but for 1917 it was easily a record. While transformers had been delivered by the hundreds of thousands of horse-power, they had also found their "Tricity" department of the greatest possible value. There was for the electrical engineering industry a large place in the world's future work. Although no industry was more hampered, perhaps, in its early days by legislation, by the "dumping" of foreign goods and of those made by sweated labour, than theirs, those matters were most certainly going to be corrected, and soon. Many of them in the engineering world were making time to attend reconstruction and other committee meetings with a view to encouraging greater co-ordination of designing, manufacturing, and other efforts, so as the better to bear their part in the future. Shareholders in such a company as theirs might well look forward with interest and satisfaction, for never before had they been so united in industry, nor, speaking broadly, so efficient. A point of greater importance, and one upon which their manager had always insisted, was that by continuing and extending in their own lines of business during the war they were contributing their greatest weight to the efforts towards victory. They had made neither actual munitions nor excess profits, but they had, by contributing many hundreds of thousands of invaluable plant and apparatus to war industry, done far better. They anticipated that after the war they should be ready immediately and fully to bear a hand for efficient reconstruction and development. In conclusion, he remarked that he had dwelt on these matters of co-operation because there was, in his opinion, imperative need of them, and he believed that their individuality and enterprise could best be maintained, even stimulated, by giving rein to the spirit of unity in preparing for peace.

Urban Electric Supply Co., Ltd.

The gross profits for 1917 were £67,732, as against £64,983 for 1916. £64,521 is carried to net profit and loss account. Interest, debenture stock redemption, and income-tax absorb £45,547, leaving, with £1,774 brought forward, £20,748. Out of this there is put to reserve for depreciation £10,000, 2½ per cent. is to be paid on the preference shares, requiring £6,250, and £4,498 is to be carried forward. In order to give additional power supply necessary to various establishments in the Twickenham Co.'s area, the Government is arranging to advance to the Urban Co. for plant and mains additions £75,000 at 6 per cent. interest on the security of a floating charge ranking behind the existing debenture stock, the repayment being spread over a term of 15 years. At the meeting shareholders will be asked to sanction an increase in the borrowing powers. The company is to be safeguarded against the risk of having to bear the cost of superfluous plant left on its hands owing to the load dropping off after the war, and with the provision of this safeguard the directors believe that the expenditure of this money advanced by the Government will prove beneficial to the company. The directors have arranged to renew the agreement with Edmundsons, which expired on March 31st last, for a further period of five years on practically the same conditions as before, except that the annual sum payable for management and administration is increased to £3,000. This sum is very considerably below any figure at which the company could be administered independently of Edmundsons, and the directors are satisfied that the increase is justified by the large expansion of the company's business and by the heavy additional expenses of administration. A comparative statement of profits derived from the undertakings and particulars of the load connected in kw. appears below:—

	Kilowatts.		Profits.	
	1916.	1917.	1916.	1917.
Hawick	3,181	3,363	£5,653	£5,863
Stamford	1,679	1,720	1,625	2,208
Weybridge and Walton	3,297	3,694	4,385	5,488
Godalming	1,498	1,800	2,040	2,247
Twickenham and District ..	8,413	9,191	16,109	15,175
Dartmouth	978	1,038	1,103	1,116
Camborne and Redruth ("A") and Cornwall ("B")	7,345	8,052	"A" 7,523 "B" 7,598	"A" 8,030 "B" 7,924
Newton Abbot	1,262	1,387	3,242	2,728
Grantham	1,852	1,989	7,640	8,703
Glossop	1,317	1,423	3,113	3,370
Berwick	1,098	1,138	647	1,066
Caterham	862	991	1,207	1,166
Newbury	1,164	1,232	3,076	3,386
Totals	33,886	36,902	£64,966	£67,717

London United Tramways, Ltd. The gross receipts for 1917 were £354,473, an increase of £18,138, but the expenses increased by £23,595. After deducting the adverse balance of £2,583 brought forward, and all expenses, the balance is £60,028, which is required for the carrying out of repairs and renewals as and when it becomes practicable to carry out such work. The charges for interest on the first mortgage debenture stock and loans amount to £71,627. Since the appointment of a receiver last June, negotiations have been carried on by the directors and a committee appointed by the 4 per cent. first mortgage debenture stockholders with a view to the reconstruction of the capital and the rehabilitation of the tramways undertaking. These negotiations have resulted in a provisional arrangement under the terms of which, subject to the Bill referred to below passing into law, both the loan and share capital will be substantially reduced, and funds will be provided for the reconstruction and renewal of the tramways. The Bill which is being promoted with the concurrence of the Debenture Stockholders' Committee, has among its objects an extension of the company's tenure of the tramways, and power to increase fares beyond the limits fixed by the company's previous Acts.

Metropolitan Electric Tramways, Ltd. The revenue for 1917 was £594,085. After including the balance brought forward, deducting expenses, and providing £22,687 for future reconstruction and renewals, the available balance is £22,910. There is put to reserve £9,874, 2 per cent. is to be paid on the preference shares requiring £10,000, and £3,036 is to be carried forward. The traffic receipts were £38,193 better than in 1916. The revised scale of fares over the whole system to meet increased cost of working only became fully operative in October. The increase of fares has undoubtedly had the effect of bringing in additional gross revenue, but "the fares will have to be raised to a higher scale if the company is to be in a position to meet the continued increase in the working expenses due to the higher cost both of materials and labour." The units sold by the North Metropolitan Electric Power Supply Co., Ltd., increased by 18 per cent. over 1916, the increase being mainly due to the larger supply given to power-users engaged in the manufacture of munitions or other war contracts. The gross profits of the Power Co. for 1917 increased by £4,759.

British Westinghouse Electric and Manufacturing Co., Ltd. The available profit for 1917, including £89,735 brought forward, is £177,859. Out of this £48,000 has been put to special depreciation of plant, machinery, &c., £10,000 to additional reserve for employers' liability, the preference dividend of 7½ per cent., less income-tax, requires £68,625, and £51,234 is to be carried forward. Mr. P. A. Lang has resigned his seat on the board, but his great experience will remain entirely at the disposal of the board in the capacity of technical adviser. Mr. Lincoln Chandler (one of the managing directors of the Metropolitan Carriage, Wagon and Finance Co., Ltd.) has been appointed managing director to fill the vacancy. Mr. W. W. Blunt, who has also resigned his seat on the board, will for the future give the whole of his time and attention to the supervision of the commercial department of the company. Sir E. V. Hiley, K.B.E. (a director of the Metropolitan Carriage, &c., Co.), and Sir F. H. Barker (a director of Vickers, Ltd.) have been elected to the board. The directors are now:—J. Annan Bryce, M.P. (chairman), Sir E. V. Hiley (vice-chairman), Sir F. H. Barker, Lieut.-Col. Montague Cradock, Norman B. Dickson, M.I.C.E., Sir E. A. Goulding, Bart., M.P., Alex. Spencer, and Lincoln Chandler (managing director). Annual meeting: May 6th.

Johnson and Phillips, Ltd. At the annual meeting held last week, Mr. W. Claude Johnson, who presided, referred with regret to the death of the late chairman, Mr. R. W. Blackwell, who had controlled the destinies of the enterprise since its inception as a public company with a success that was patent to all. The figures in the annual report showed a considerable improvement over those of 1916. The trading profit for the year showed an increase of about £14,000. The reserve account now stood at £40,000, and the special reserve account £10,000, while the reserve *re* debenture sinking fund and the debenture redemption suspense account amounted together to £78,251, making a total reserve of £128,251. The total assets now exceeded current liabilities, including all debentures, by well over £320,000. These figures demonstrated that the business was in a thoroughly sound position. A further sum of £11,000 odd had been expended during the year on additional buildings and plant. The output for the year under review was a record by a very large amount, and they would be interested to hear that the turnover for the current year far exceeded that of the corresponding period of last year and the works were as full up as they could well be with orders, which fully justified the large outlay on new plant made by the company during the last few years. They had, of course, had a great many difficulties to meet in carrying out the vast amount of work entrusted to them, but they had met the position as successfully as possible under existing circumstances. Material had become more and more difficult to obtain, and the question of labour had caused constant anxiety. The men had worked both loyally and patriotically. As to the future, it was impossible to foretell what might happen during the next 12 months, but as far as the board could see there seemed little doubt that the output would be maintained, and there was no reason to think they would not get their fair share of any business that might be going.

Mr. Thomas Deuce said that the present position of the company as compared with what it was five years ago was a very pleasing contrast, and the improvement had been brought about largely by the work and devotion of Mr. Blackwell, assisted by the other directors.

Replying to a shareholder, the Chairman said there was no part of the works idle. Their factory at Charlton was fortunately fitted up with machinery that complied so well with present requirements that there was hardly such a thing as an obsolete machine in the place. He believed their work in connection with submarine matters would revive with great energy after the war. The works were designed not only for making and designing machinery for laying and picking up submarine cables, but for making them, and prior to the war they made machines not only for English firms, but also for those abroad.

Coalite, Ltd.—The report for 1917 states that by the appropriation of the surplus of reserve account the item of general expenditure in the balance sheet was reduced by £12,495. The directors have arranged with various creditors for a substantial reduction of their claims. This, with the assistance of various other credits, makes the balance added to this item only £191 for the year. An agreement has been entered into with Low Temperature Carbonisation, Ltd., to manage that business for 10 years. Effective progress in dealing with the company's interests in foreign countries and the Colonies can, however, hardly be looked for until after the termination of the war. The company's patents in foreign countries and the British Dominions have been maintained and added to during the past year.—*Financial Times.*

Bath Electric Tramways, Ltd.—Mr. J. B. Hamilton, presiding at the annual meeting, said that the traffic revenue had increased by £4,784. The character of the traffic had changed, due to the war. The working costs had risen considerably. The outlook for the current year was less cheerful. They were to reduce their coal consumption, which meant a reduction in power which might vitally affect earning capacity, but they would try to meet the situation by altering their stoking plant, and, perhaps, the class of fuel used, and thus attain the desired result without causing more than a small reduction in mileage. The tramway undertakings desired to increase fares to compensate them for increased cost, and a Bill was to be introduced by the Board of Trade after a committee had inquired into the merits of their applications.

South Metropolitan Electric Tramways & Lighting Co., Ltd.—The revenue from all sources in 1917 was £86,139, compared with £68,793 for 1916. After adding the balance brought forward, deducting expenses, and setting aside £6,000 to the renewals fund, the surplus is £20,152. There is put to reserve £4,000, dividend of 6 per cent. on the preference shares for 1916 absorbs £10,174, and payment on account of preference dividend for 1917 at the rate of 3 per cent. £5,087, leaving to be carried forward £891.

Browett, Lindley & Co., Ltd.—After paying a full year's dividend at 6 per cent. per annum on the preference shares, and a further 4½ per cent. thereon on account of arrears, less tax, the ordinary shareholders receive 6 per cent. per annum, less tax, for 1917.

Altrincham Electric Supply, Ltd.—Mr. C. J. Ford, presiding at the annual meeting, said that the operations of the year, though difficult, had been more favourable. Sale of current for power would provide the main portion of the profits in future. The district would show further industrial expansion during the next few years.

Argentine Tramways & Power Co.—During the year ended September, 1917, the tramway receipts showed a decrease, partly due to a strike, but economies were effected. There was an increase in light and power receipts, and in net revenue. Owing to the war progress has not been sufficient to permit of payment of the preference dividend. No large improvement is expected while the war lasts.

North Metropolitan Electric Power Supply Co.—Dividend at the rate of 6 per cent. per annum, and a bonus of 8s. per share, on the ordinary shares for 1917.

West India & Panama Telegraph Co., Ltd.—Final dividend for 1917 6d. per share, and a bonus of 3d. per share on the ordinary shares, free of tax.

Monte Video Telephone Co., Ltd.—Interim dividend for the half-year ended January 31st at the rate of 6 per cent. per annum, free of tax, on the ordinary shares.

City of Buenos Aires Tramways Co. (1904), Ltd.—Quarterly dividend of 1s. 3d. per share (5 per cent. per annum), less tax.

River Plate Electricity Co., Ltd.—Dividend on the ordinary shares 7 per cent. for 1917.

F. Reddaway & Co., Ltd.—Profit for 1917 £646,644, against £12,534. Dividend on ordinary shares 8 per cent., carrying forward £21,529. Unless the restrictions imposed by the War Trade Department on the export of canvas hose and beltings are modified the board will have to consider the closing down of the textile section of the works.

Clarke, Chapman & Co., Ltd.—The £10 ordinary shares are to be divided into 10 shares of £1 each, and the preference dividend is to be increased from 6 per cent. to 7 per cent.

Auckland Electric Tramways Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum, less tax, is to be paid on the ordinary shares.

Stewarts & Lloyds, Ltd.—Resolutions have been passed increasing the capital to £3,100,000 by the creation of 850,000 deferred shares of £1 each, of which one half are to be issued.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—The Treasury has sanctioned the issue of £17,500 6 per cent. prior lien debentures (£100 each), which are being offered to the share and debenture holders.

Direct United States Cable Co., Ltd.—The reserve fund at March 31st showed a balance of £528,626, an increase of £26,115 for the year. A final dividend of 2s. per share, less tax, makes a total of 4 per cent. for the year.

Adelaide Electric Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 10 per cent. per annum, free of British income-tax.

Melbourne Electric Supply Co., Ltd.—Interim dividend on the consolidated ordinary stock at the rate of 10 per cent. per annum, free of British income-tax

Evered & Co., Ltd.—Though the accounts for 1917 cannot be issued, the figures are sufficiently satisfactory to allow of the payment of a dividend of 8 per cent. per annum, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets continue to hang upon the news from the Western Front. There is not much change in prices, because there is not much business doing. The effect of the Budget can be said to have worn off. One rather surprising result is a stiffening of prices amongst the best class of securities, holders of which were relieved to find that the income-tax was not put up more than 1s. in the £, while people with money to spare have begun once more to look at gilt-edged investments. Strength in the war stocks makes a contribution to this movement. Once again it deserves mention that there are comparatively few good debenture stocks or preference shares obtainable, whereas a month ago the supply became augmented on behalf of those who anticipated a much more severe income-tax than the Chancellor has imposed.

Underground Electric Railway income bonds have given way to 74, because of the apprehension felt in some quarters that the rise in the income-tax may result in a diminution of the 4 per cent. interest which the company is now paying on these bonds. Except for this, the railway market on the whole is rather better, and Metropolitans have recovered ½. Steam stocks are also on the firm side.

The demand for cable and cable manufacturing shares, the dividends on which are paid tax-free, remains insistent. No particular changes have occurred in prices. Great Northerns are better at 36½. The Eastern group continues very strong, and all the improvements secured last week have been maintained. Oriental Telephones have risen to 4 3/16, and United River Plate are better at 7. Anglo-American preferred at 93 is ex dividend, and the ordinary stock is also quoted ex at 56. In the manufacturing group, Henleys, Callenders, and British Insulated are decidedly good, and the electrical manufacturing list is fairly steady. British Aluminium have further receded, in consequence of opposition that has developed to the company's water scheme in the Highlands. Lively controversy goes on in regard to what the objectors to the scheme lament as a blow to the natural charm of the locality, while, on the other hand, the economic advantages of the proposals are held to outweigh any disturbance to the beauties of nature that may be caused.

British Westinghouse preference have fallen to 2½, on the issue of a report which can only be regarded as disappointing. The net profit has fallen from £199,000 to £88,000; the preference shares again get 7½ per cent., but this time it is not free of tax. Last year the company wrote off £25,000 from patents and goodwill, but nothing is set down in the present accounts against this item. The carry-over of £51,000 is £38,000 less than that brought in from last year. This is a very unpleasant jar to those who were talking about the possibility of the company being able to raise its dividend almost at once. It was less on dividend hopes than on the expectation of a combination of interests that the price of the shares was recently run up to 3 3/16, though the combination idea seems to have evaporated into thin air, at all events for the present. But well-informed folk think that this is certainly not the time to sell Westinghouse preference.

London shares continue dull in the list of home electricity issues. Citys are ¼ down at 12, and Countys eased off to 10⅜. There seem to be shares about which take some time to absorb. Charing Cross keep heavy at 3¼. The North Metropolitan Supply Co. repeats its former dividend of 10 per cent., and the £81,000 available for distribution is about £600 better than a year ago.

Amongst foreign descriptions, Brazil Tractions have been better at 42½, reverting, however, to 42, and thus showing no change on the week. Anglo-Argentine 5 per cent. debenture stock lost a point, and British Columbia Electric 4½ per cent. debenture stock at 57 is similarly down. There is no improvement in Mexican varieties. The market remains frankly dull, and the tendency is still to sell where opportunity occurs for doing so. Some of the Brazilian bonds are rather better, and Sao Paulo first mortgage debentures have hardened to 87, which is about the same price as the 5 per cent. first mortgage gold bonds of the Rio Tramways. Victoria Falls preference have advanced to 22s., with a fair amount of business doing in them, and the ordinary shares are a little better at 17s. 6d. Industrials keep pretty steady on the whole. Armament, iron, coal, and steel shares are hard on the fact of the excess profits duty not having been raised. A further sensational rise in the price of tin has caused but little fresh activity in tin mining shares. Rubbers are quiescent, a rise to 2s. 6d. in the price of the material being followed by reaction of a few halfpence.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price April 30, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6¾	—	£7 8 0
Charing Cross Ordinary	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3	—	8 6 8
City of London	8	8	12	— ¼	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	— ⅛	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	8	4	3⅜	—	5 18 6
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 18 4
St. James' and Pall Mall	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.	Price	Rise or fall	Yield
Anglo-Am. Tel. Pref.	6	6	93xd	—	6 7 8
do. Def.	81/6	1½	22½	—	6 14 10
Chile Telephone	8	8	7⅜	—	5 8 4
Cuba Sub. Ord.	5	7	9¾	—	*7 3 7
Eastern Extension	8	8	15⅜	—	*5 4 1
Eastern Tel. Ord.	8	8	15¼	—	*5 4 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. Pref.	6	6	9¾	—	6 3 1
Great Northern Tel.	22	24	36½	—	6 11 6
Indo-European	18	19	51½	—	6 6 8
Marconi	10	15	3⅛	—	4 17 10
Oriental Telephone Ord.	10	10	4 3/16	+ 1/16	2 10 0
United R. Plate Tel.	8	8	7	+ ⅛	*5 15 4
West India and Pan.	6d.	6d.	1½	—	*3 6 8
Western Telegraph	7	8	15⅜	—	*5 4 1

Home Rails.

Central London, Ord. Assented	4	4	62½	+ 1	6 8 0
Metropolitan	1	1	20¼	+ ½	4 18 9
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A"	Nil	Nil	4/6	—	Nil
do. do. Income	6	4	74	—1	*5 6 8

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	2¾	—	—
do. 2nd Pref.	5½	—	2½	—	—
do. 5 Deb.	5	5	63	—1	7 16 4
Brazil Tractions	4	4	42	+1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	51½	—1	9 14 2
do. do. Preferred	Nil	Nil	32½	—	Nil
do. do. Deferred	Nil	Nil	25½	—	Nil
do. do. Deb.	4½	4½	57	—1	7 6 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	36	—	Nil
do. 6 per cent. Bonds	Nil	Nil	80	—	Nil
Mexican Light Common	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	29	—	Nil
do. 1st Bonds	Nil	Nil	86½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3¼	—	4 13 4
British Aluminium Ord.	7	10	1 9/16	— 1/32	6 8 0
British Insulated Ord.	17½	20	8⅜	—	5 10 4
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8¾	—	5 14 3
Edison Swan, fully paid	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1¼	—	6 0 0
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	20¼	—	4 18 9
Henley	25	25	19xd	—	6 6 7
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15⅝	— ⅛	*6 8 0
Telegraph Con.	20	20	42	—	*5 18 0

* Dividends paid free of income-tax.

DISABLED SOLDIERS AS METER REPAIRERS IN GLASGOW CORPORATION ELECTRICITY DEPARTMENT.

During the early part of 1917 the chief engineer of the G.C.E.D. decided to give employment to a number of disabled soldiers. The decision was arrived at purely on humanitarian grounds, as every day brought in a considerable number of men seeking employment, who almost invariably reported that they had failed to get anything more than expressions of sympathy in their search for work. A number of the men were allocated to the meter-repair workshop, and it is the purpose of this article to describe in some detail the results of the experiment.

The men were taken practically at random from a batch of applicants, and in no case had they previous experience of any value. The diversity of trades may be gathered from the fact that the list included a miner, a railway shunter, a tramcar conductor, and a calico printer. The nature of their disablement was in all cases loss of one leg. The only hopeful point seemed to be the very respectable class of men and their undoubted anxiety to acquire sufficient knowledge and skill to render themselves self-supporting.

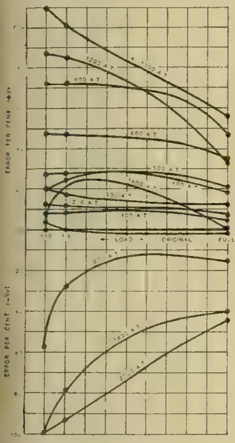


Fig. 1.—Ferranti 5 A. d.c. Meter.

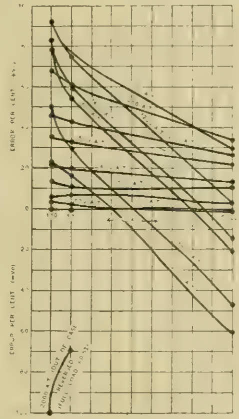


Fig. 2.—C. & H. 5 A. Meter.

Tests on Effect of Reducing Strength of Magnets.

The work to which attention was first given was the repairing and cleaning of Chamberlain & Hookham and Ferranti mercury-bath ampere-hour meters. A meter was taken apart, and the various pieces were mounted neatly on a wooden board to serve for demonstration purposes. The names of the parts were then gone over, and the general construction was explained by an experienced workman. A demonstration of dismantling and reassembling was then given, and the order in which the various operations should be carried out was carefully emphasised. It was decided that each man should carry out all the work on the meter himself, so as to make matters as interesting as possible. This method of working calls for greater all-round skill on the part of the meter repairer, but has the great advantage that the absence of any man does not affect the output of the others. For some time afterwards, all the men were kept on one type of meter, and an experienced worker helped whenever difficulties appeared. During the early stages it seemed likely that some of the men would fail to obtain the starting-current results desired; but in the course of a few weeks, this difficulty disappeared, and the results are now entirely satisfactory.

One feature of the experiment must be recorded at this point—namely, the very willing and generous way in which the meter repairers gave their assistance to the soldiers. Whenever any difficulties appeared these men gave the learners the benefit of their experience, and it is largely due to this fact that the experiment proved successful.

Later on, when new types of meters were brought in for repair, everyone was anxious to master the work in the minimum of time, and after a few days' practice, each soldier could readily overhaul any type of meter put before him.

The mechanical part of the training had nothing at all special in it, the only points emphasised being the necessity for absolute cleanliness and tidiness, and in this respect the new-comers soon surpassed the older workmen.

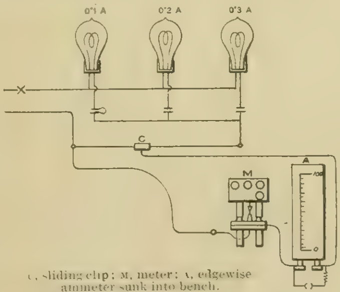
The working hours were at first 6.30—9, 9.45—1, 1.30—5.45, but later on these were reduced to 8—12.30, 1.30—5.45, with very satisfactory results. Smoking was allowed during two 20-minute periods each day, and this seemed to be appreciated.

In order to create and maintain interest in the work, weekly lectures on electricity were instituted. These were held during working hours, and simple demonstrations of magnetic and electric phenomena helped to clear up many of the difficulties met with in the course of the work.

Whenever a meter failed to pass the laboratory tests it was returned to the repairer along with the test results, and when anything of special interest occurred, it was explained to all the men as well as to the person directly concerned. As an example of this, it was found that several men remarked on the fact that a large proportion of the meters which did not pass were correct on full load, but fast on light loads, while the starting currents showed the meters to be in good mechanical order. It was explained generally that this trouble was due to weak magnets, and, in order to emphasise the point, the magnets of two good meters were demagnetised by definite steps, and tested at each step. The results of these tests are shown in figs. 1 and 2. The effects of remagnetising were also explained and demonstrated.

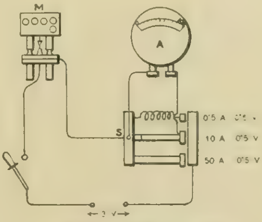
The great interest shown in these tests and lectures, which from lack of time could not be properly prepared, encouraged the superintendent to ask for assistance from the meter manufacturers. This was promptly given, and each of the companies from which meters are bought sent a representative to give a lecture and demonstration of his particular speciality. This movement made a very great difference in the methods employed in handling meters, and many of the time-honoured practices of the G.C.E.D. meter workshops were relegated to the scrap heap.

As time went on the men became more confident, and instituted improvements on their own initiative—for example, they connected up their lamps for starting-current tests in series, so as to get lower currents for test purposes. They also made rough tests on meters by calibrating several lamps to give different loads. To encourage this spirit each bench will now be provided with a variable-range ammeter and simple arrangements to give currents up to 0·5 ampere. A sketch of the fittings provided is shown in fig. 3. The reason for using this method was that it gave the results with minimum delay and cost, the lamp board being already in existence and the ammeters having been taken from a discarded switchboard. All data regarding the instruments are marked clearly on the scales.



C, sliding clip; M, meter; A, edgewise ammeter sunk into bench.

Fig. 3.—Apparatus for Starting-Current Tests.



A, precision ammeter; S, shunts; M, meter under test.

Fig. 4.—Apparatus for Testing Meters before Casing.

The standard practice of the department is to use mercury ampere-hour meters for house service, and so these form the bulk of the work; but the men are shown the construction of other types of meters whenever opportunity occurs. They now know the general features of commutator and electrolytic meters, and have also been shown one or two types of alternating-current meters.

The laboratory tests and the calculations involved are also well understood by the meter repairers, and they are occasionally called on to assist in testing and adjusting meters.

A further operation is to be performed on meters in the course of repair, in order to diminish the probability of failure during the acceptance tests in the laboratory. This is to test each meter at two loads before it is put into its case. The points chosen are full load and 20 per cent. of full load; the testing arrangements are shown in fig. 4. In this case, too, existing apparatus was utilised, as far as possible, so as to minimise capital expenditure. The shunts were made in the workshop of the department, and were arranged to suit standard meter capacities. Meters of over 100-ampere capacity are tested at this stage without their shunts.

This test will be performed by the repairers themselves, the men each taking a week of testing in succession.

In order to provide an occasional break in the routine, men who have attained sufficient arithmetical proficiency, and who volunteer for the work, will be trained as observers for machine tests. It is hoped thereby to enable the department to make regular steam consumption tests on turbines at a reasonable cost, and the work will at the same time provide interesting recreation for a very deserving class of men.

The general conclusion drawn from experience is that the experiment is completely successful, from the standpoint of both sound workmanship and finance. Electricity supply undertakings can confidently be recommended to try disabled soldiers as meter repairers, and they can rest assured that a very few weeks of practice will enable any intelligent man to master the essentials of the work. It stands to reason, however, that payment must be on a fairly liberal scale even during the non-productive period, as otherwise the men will be discontented and Trade-Union troubles are sure to occur.

THE SAVING OF FUEL.

By C. M. BENNETT, Wood Lane Works.

Everybody connected with the management of works where coal is used for the purpose of power production understands the importance of making use of the coal in the most economical manner possible; nevertheless, the importance of strict boiler-house supervision and organisation has not been, and is not always, fully recognised. It is in the boiler house that the greatest saving can be made, and in times like the present, when economy in fuel is of national importance, the attention of engineers should be directed towards the organisation of the boiler house—the Cinderella of generating stations and industrial works generally.

If we look into the past, we shall find that the boiler house, or stokehold, as it was called, did not receive the same attention at the hands of the engineers and managers of undertakings as did the engine house. Perhaps this was natural when looked at from the point of view of personal comfort and cleanliness. The engineer is a person of some consequence, and although he may be temporarily disfigured by a spot of oil without loss of dignity, a smudge from coal on any portion of his person was not to be thought of.

For some reason or other, the most important place seemed to be that in which the generating machinery was housed. The mental efforts of the engineers were directed towards schemes and refinements to improve the economy of this section of the plant, to embellish it with the most wonderful flights of architectural genius, and to add to the comforts of the staff in the engine house. As long as the coal was burning in the furnaces, how well or badly it was burning so long as pressure was maintained did not matter much.

From the time of the first conception of a new power house, even in the preliminary sketches in the consulting engineers' office, the position and design of the boiler house seemed only a secondary consideration. The engine house must have a colour scheme in glazed bricks, but anything would do for the boiler house as long as the old colour scheme of black was thoroughly carried out, the want of ventilation was very marked, and natural light was more or less eliminated. The accommodation of the steam-raising plant in dark and underground places was the rule.

It is perfectly certain that if the same care and attention were given to the design of the building and to the comfort of the steam-raising staff as to the design of the engine house and the comfort of the staff operating therein, the effect on the economical production of power would be at once very marked.

The attention of young engineers and chemists would be directed towards this most important branch of power production, and men would be encouraged to specialise in boiler-house operation and fuel economy. The conditions and surroundings should be such as would attract them: a boiler house, in fact, should be just as much a show place for visitors as the engine room is. The utmost space should be reserved for natural light, and the best possible scheme for ventilation, and the removal of coal dust and fumes, should be adopted. The walls should be faced with white glazed bricks, and every effort should be made to obtain and preserve a bright, spick-and-span appearance.

There is a natural tendency to consider that the boiler-house staff comes second to that of the engine house; this is a great mistake. It is the opinion of the writer that the boiler-house staff comes first, for the boiler house is the heart of the whole undertaking, and more money can be saved in this section of a works than in any other. Perhaps the day will come when the charge engineer in the boiler house will be in a position to abuse the charge engineer in the engine house for wasting his coal by allowing the steam traps to dribble, and the lagging on the steam pipes to remain defective. Perhaps the charge engineer in the boiler house will have something to say about the engineers taking more steam in consequence of dirty condensers. Concentration and keen interest will only come about when the conditions obtaining in most boiler houses are altered, and this most important section of the works is put upon the plane of importance it should justly occupy. Then, and only then, will scientific boiler-house operation attract the attention of the right sort of men, and only then will the interest of young engineers be directed towards the boiler house in preference to the engine house. Boiler-house operation and management will become a department of itself in a works organisation. The purchase of suitable fuel, the classification of fuels, their heating value, the question of feed temperatures, draught, boiler conditions, coal handling, ash handling, ash weighing, gas analysis—in fact, everything pertaining to the boiler house—will be cared for by a department distinct and separate from the engine-house operating department. Such organisation will lead to the best results.

The more general use of mechanical stokers has done a great deal towards improving the boiler-house conditions, inasmuch as the atmosphere has been freed from coal dust, and the underfoot grinding of coal has been largely reduced by the adoption of bunker feed to the coal-hoppers. Further, suction plant for the handling of ashes has made the ash tunnels more healthy to work in, and the general improvement of coal-handling apparatus, wagon tippers, &c., has minimised the necessity for man-handling the coal.

All this is tending in the right direction, but there is a great deal to be done yet before the boiler house is given its proper place in the works organisation. The manufacturers of boiler-house plant and apparatus should look to it that the finish of their products is equal to, or better than, that of plant and apparatus manufactured for use in the engine house. If engineers express the opinion that any rough finish is good enough for the boiler house, how can they expect to induce in their employés that interest in the cleanliness and operation of the plant which is so very essential? The chimney, because of its architectural beauty (?), receives close attention, and the pointing of the brickwork must be regularly done, but obvious cracks in the walls of the boiler setting for the admission of air remain unattended to. In some places one has to travel about with a duck-lamp to inspect the blow-off cocks of the boilers; even an electric plug position is denied, or was overlooked in scheming out the boiler house, while the engine house is bristling with them.

Even the Board of Trade Inspectors do not seem to notice the unguarded traps which in the engine house and machine shop would immediately attract their attention. Perhaps it is because the boiler house seems to them dark and uninteresting.

The cry for economy in fuel is welcome, although the cause of its coming is to be regretted, for, perhaps, it will be the means of preparing the way for better things, and of clearing away for ever the dark and dusty boiler houses which exist all over the country; perhaps it will be the means of creating a real and lively interest in boiler-house operation, and making the boiler house what it should be—a bright, airy, and clean department of the works, comparing favourably in cleanliness and tidiness with the engine house to which it supplies its product. Then, indeed, will the coal per unit generated be reduced, and brains will be attracted towards the boiler house just as much as they are now attracted towards the engine house. There is a deal to study, a deal to learn, and the reward will be as great as, if not greater than, any which can be earned in any other department of a works organisation.

The high price of coal, and the limited quantity available, make the problem of its economical use more imperative than ever. A thorough reorganisation of boiler-house methods is necessary and essential; for, under present conditions of operation, faults and waste are certainly not as easily detected as equivalent faults and waste would be in the engine house. A leaky blow-off cock hidden away somewhere will not be noticed as quickly as a leaky gland in the engine room; yet it is a condition of wasting fuel. Ill-fitting dampers and a host of other things all spelling fuel wastage are apt to be neglected, simply because of the difficulty of inspection, largely due to faulty lay-out of the plant, or the necessity of climbing over a heap of coal to get at the job. The day will come when the boiler house will be an airy, light, palatial building like the engine house, and scientifically trained men will move about in their work of organisation and inspection, their white jackets testifying to the non-existence of dark and dusty corners, the installation of dust extractors, &c. No longer will gas masks be necessary for ash-tunnel inspections. All will be well in the boiler house, and the ignorant waste of fuel a condition of the past.

COAL CONSERVATION AND ELECTRICAL POWER.

The report of the Coal Conservation Sub-Committee on Electric Power Supply in Great Britain was discussed at a meeting in Newcastle-on-Tyne on April 15th, held under the auspices of the Newcastle Local Section of the Institution of Electrical Engineers. Invitations had been extended to members of the North-East Coast Institution of Engineers and Shipbuilders, North of England Mining and Mechanical Engineers, North of England Branch of the Association of Mining Electrical Engineers, and kindred bodies.

Mr. A. H. Marshall, chairman, said that perhaps the main object in holding that meeting was to obtain publicity for the report of the Coal Conservation Sub-Committee on Electrical Power, which was of such importance generally. The most important matter after the due prosecution of the war was provision for the difficulties which would lie before them when they entered upon the time of reconstruction. They should do whatever they were able to do to develop their resources, and nothing was more likely to prove helpful in this respect than the proposals contained in that report. The suggested economies that might be effected made a striking appeal, and if legislation were to follow, it was necessary they should bring the matter before the public. The financial aspect of the question was an important one, and he thought there were special reasons for the Government giving support to the scheme during construction, for it would increase the productive capacity of the country, and the money so advanced would come back to them in the course of time.

Mr. C. Vernier said one of the greatest problems raised by the war was that of meeting the colossal war debt that would remain at the end. There was only one safe course to follow, and that was to increase the productivity of our industries, trade, and commerce, thus increasing the national income so that we might face the future with equanimity. There must be, too, better relations between employers and employed, and an avoidance of all restriction of output, be the cause what it might. He pointed out that we were nearer the point of exhaustion of our coal supplies than any other important industrial country, and there was something more in the question than the exact amount of coal remaining; there was the further question as to how long we could continue to get it at a reasonable price. Coal prices had advanced by 38 per cent. in 13 years. In view of these facts it was necessary that we should give something more than passing attention to these important matters. With regard to super-power stations, he thought the report was right in recommending private enterprise as more likely to be best in the national interests.

Mr. W. C. Mountain said he did not think anyone would dispute the fact that a general supply of electrical energy at prices which would render its use a commercial advantage to manufacturers and others was highly desirable. It was very important that consumers should not be led to believe that such supply could be obtained within a reasonably short period, thus preventing their making improvements or additions. In connection with various important schemes he had in hand there had been an attempt by officials of the Government to prevent the installation of plant designed to take advantage of existing waste heat, such as exhaust steam and gases from coke ovens and blast furnaces, and it was suggested by these officials that power should be taken from power stations, instead of consumers installing their own plant, notwithstanding the fact that in most cases no power stations existed in the neighbourhood. Such procedure, if insisted upon, would naturally prejudice future progress, and, whilst he would be the last to advocate any scheme being carried out which would involve any expenditure of unnecessary capital, he was convinced from his own experience, that there was a large number of undertakings in this country which could produce electricity at a very much lower cost than it could be either produced or supplied at by any power stations installed for a general supply. There was no suggestion in the report as to the financial aspect of the scheme, and he thought the public should be informed not only of the probable cost, but where it was proposed to obtain the capital, and upon what terms. Also, he thought an indication should be given as to the terms upon which energy was to be supplied. He saw no reason why a flat-rate should not be quoted, with discounts varying in proportion to the consumption. In the report it was stated that the price of current supplied by the Newcastle Electric Supply Co. was under ½d. per unit on the average. That was not borne out by the charges made to consumers in the district with which he was associated. It was true that collieries obtained supplies at low rates somewhat approaching the figure named, but the charges for current for engineering works, shipyards, &c., were considerably higher. In the case of the Park Gate Iron & Steel Co., Ltd., the units generated in six months ended Dec. 31st, 1917, were 3,701,675, cost per unit, .1429d.; and at the Devonshire Works, units generated in the year were 17,500,000, cost per unit .1094d. Surely firms like these would not be forced to take current even at .5d., from a supply company. The report should make it perfectly clear to those in a position to produce their own electrical energy from waste heat, or from other sources, such as inferior coal, that they would not be handicapped or prevented from so producing their own power if they desired to do so. He expected considerable difficulties in dealing with existing power stations, and he thought some indication should be given as to the method of dealing with matters of that kind.

Mr. H. W. Clothier said the "average charge of ½d. per unit" of the Newcastle Supply Co. looked very small, but in their bills they found 3¾d. per unit charged, and now the company was proposing to raise the charges to private consumers by 20 per cent. If it were possible to obtain power at a cheaper rate than a manufacturer could himself make it at, it would pay to scrap less efficient plant, but he thought no business committee would suggest doing that with such plant as Mr. Mountain had instanced. He pointed out that the report did not deal with the cost of transmission, and he also thought something might be done to further research.

Capt. A. H. Law said he thought caution must be exercised at the close of the war, if it came suddenly as was thought by some, to see that they were not rushed into some scheme which was bad from an engineering standpoint. If they kept that thought in mind, and so get the best out of it, he thought the report would do a great deal of good.

Mr. Mark Haliday said that at the Tursdale Colliery, in Durham, a scheme had been adopted whereby the whole of the steam was raised by waste heat from the bee-hive coke ovens. After reconstruction of the plant the fuel costs had come down from £1,300 per month to between £400 and £500 per month, and they were using ballast which before was wasted. That showed what could be done by private firms in the way of economy.

Mr. W. T. MacCall, speaking of the feeling between municipalities and private companies, suggested that perhaps the best way would be to appoint a board for each district. He thought it was a pity there was no proposal to ear-mark a portion of the savings for research work.

Mr. J. R. Andrews, speaking as a private consumer, said he thought one good that might result from those big stations was a uniformity in price for energy.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

MEXICO.—A Decree, dated September 22nd, fixed the export duties on guayule rubber as follows:—

Guayule plants and other india-rubber yielding plants (on rubber contents)	6 p.c. *ad val.*
Guayule rubber	4 p.c. *ad val.*

For the purpose of the Decree, the guayule plant is to be regarded as containing 10 per cent. of rubber. The Minister of Finance is empowered to fix the specific rates which shall rule for quarterly periods for the payment of the duties.

AUSTRALIA.—In reference to the approved form of declaration which is required by the Department of Trade and Customs to be printed or stamped on invoices for goods exported to Australia (see the Electrical Review for December 21st), H.M. Trade Commissioner in the Commonwealth has reported that a composite form has been issued covering both the Invoice Declaration and the Certificate of Origin (which, of course, is still necessary for goods claiming preferential treatment). The date for the enforcement of the new Invoice Declaration does not appear to have been fixed yet.

UNION OF SOUTH AFRICA.—Among recent decisions issued by the Commissioner of Customs as to the classification of various articles under the Union Customs Tariff are the following:—

	Rate of import duty.	Rebate on goods manufactured in the U.K. and reciprocating British Colonies.
Corning conahones (parts of electric or gas lamps, not hand)	3 p.c. *ad val.*	Whole duty.
Electric motor tire pump ...	3 p.c. *ad val.*	Whole duty.
Electromagnets (parts of crane)	3 p.c. *ad val.*	Whole duty.

CUBA.—The President of Cuba has issued a Decree, dated October 4th, providing that certain articles may not be exported or re-exported from the Island except under licence issued by the Treasury Department (Secretaria de Hacienda). The list of goods covered by the prohibition is practically identical with the United States' list.

ARGENTINA.—Two Bills have been laid before the Argentine Congress recently, the first to make provision for certain modifications of the Tariff Law and Customs Regulations, and the second for the constitution of a Committee charged with the duty of revising the Valuation Tariff. (This Tariff determines the values of imported merchandise for the purpose of the assessment of the established *ad valorem* duties.) The proposals contained in the first Bill are mainly directed towards the continuation in force of the temporary additional taxation introduced last year to increase the revenue. Article 13 embodies the proposal (already noted in the Electrical Review for October 26th, 1917) respecting the increase of the Tariff valuations in regard to goods imported without immediate wrappings and packings. Under Article 14 it is proposed that all goods, or produce of any kind, imported or exported, whether subject to duty or free, and those which are cleared in transit for abroad, shall pay the statistical tax at the rate of 3 per mil on the valuations contained in the Customs documents.

As regards the second Bill, it may be mentioned that a project for the revision of the Valuation Tariff, on somewhat similar lines, has been before Congress for some years past, but has not been enacted. Article 3 of the present Bill requires the production of Consular invoices in support of the declared value of such goods as may not be included in the Valuation Tariff. Articles 11 and 12 relate to the periods within which the valuations decided upon become operative, and Article 13 provides that valuations once incorporated in the Tariff shall not be modified for a period of three years, and that six months' notice must be given of any modifications.

NORWAY.—The exportation of dry cells of all kinds, and of lead and alloys thereof in any form, materials, and goods which contain lead or lead alloys in any substantial proportion, has been prohibited. (These are extensions of existing prohibitions.)

PORTUGAL (ANGOLA).—A Decree was promulgated on November 21st providing that, during the continuance of the war, an additional import duty of 10 per cent. *ad valorem* shall be levied at the Custom Houses of the Province of Angola on all merchandise except certain specified foodstuffs.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,327. "Signal devices for motor vehicles." Benjamin Electric, Ltd. April 15th. (U.S.A., June 18th, 1917.)

6,370. "Ignition magneto for internal-combustion engines." A. Santinello, A. L. Wilcken & R. Wilcken. April 15th. (France, April 14th, 1917.)

6,384. "Valves of wireless transmission systems." W. J. Davies, Edison Swan Electric Co. & C. E. Hiatt. April 15th.

6,386. "Automatic telephone exchange system." W. C. Davey & Sterling Telephone & Electric Co. April 15th.

6,388. "Telephones." C. Teasdale Buckell. April 15th.

6,418. "Magnetic friction clutches." W. Langdon-Davies & A. Soames. April 16th.

6,432. "Electric coils." W. H. Exley & H. Leitner. April 16th.

6,453. "Electrically-heated machine for stamping metal articles." J. Bill. April 16th.

6,459. "Electrodes for spark discharges." R. Bosch Akt. Ges April 16th. (Germany, April 16th, 1917.)

6,466. "Electricity meters." Landis & Gyr Akt. Ges. April 16th. (Switzerland, April 19th, 1917.)

6,517. "Means for rendering absorption by a thermophile, &c., of infrared radiations audible in a telephone for signailing, &c." L. Bellingham and Bellingham & Stanley. April 17th.

6,524 "Ignition plugs for internal-combustion motors." S. Z. de Ferranti. April 17th.

6,562. "Gas or electric cookers and solid fuel stoves and incinerators working in combination or singly." E. J. Jenkins & A. S. Smith. April 18th.

6,563. "Electric furnaces." H. Etchells, H. A. Greaves & T. H. Watson and Co. April 18th.

6,571. "Contact-breakers for magnetos." P. G. Stickley. April 18th.

6,599. "Synchronous dynamo-electric machines." British Thomson-Houston Co. & R. D. Given April 18th.

6,611 "Self-acting electric switch." Trout Curtis & Co. and J. H. Wickett. April 18th.

6,629. "Device for locking electric lamps in lampholders." A. H. Marsh. April 19th.

6,641. "Electric switches." G. O. Donovan & W. Donovan. April 19th.

6,657 "Method of mounting electric storage batteries, &c., containing liquids on aircraft, boats, &c, so that none of the liquid shall escape." H. M. Genese. April 19th.

6,659. "Electromagnetic switches." British Thomson-Houston Co. and H. C. Hastings. April 19th.

6,660/1. "Electric furnaces." T. A. D. Lawton. April 19th.

6,672. "Sparking plugs for internal-combustion engines." V. Perrett. April 19th.

6,678. "Working of electric furnaces, and electrode used therein." F. E. Berry. April 19th.

6,679. "Electric relays." W. P. Granville & W. S. Smith. April 19th.

6,682. "Electrically-operated drilling apparatus." H. Scholey & F. K. Woodroffe. April 19th.

6,698. "Electrically-driven hoists." A. Lanz & Veritys, Ltd. April 20th.

6,706. "Protective devices for alternating-current electric systems." A. E. McColl. April 20th.

6,707. "Machine switching telephone exchange systems." L. Polinkowsky and Western Electric Co April 20th.

6,717. "Magnetos." C. A Vandervell & Co April 20th

6,718. "Magneto electric machines." A. H. Midgley (C. H. Vandervell and Co.). April 20th.

6,724. "Signalling apparatus, &c." J. N. Caught & L. Mayne. April 20th.

6,725 "Machines for making dry-battery parts." D. Barclay & British Ever-Ready Co. April 20th.

6,727 "Glands for electric cables, shafting, &c." W G. Wheeler April 20th.

PUBLISHED SPECIFICATIONS.

The numbers underlined are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1916.

6,406. Ignition Systems for Internal-combustion Engines. C. F. Kettering August 30th, 1915. (101,334.)

1917.

155. Electromagnetic Regulating and Switching Devices. Electric and Ordnance Accessories Co. & J. Etchells. January 3rd, 1917. (114,320.)

3,419. Electric Signalling Systems. H. Green. March 8th, 1917. (114,325.)

4,228. Electric Generating and Battery-charging Installations for Railway and other Vehicles. J. Stone & Co. and A. H. Darker. March 23rd, 1917. (114,332.)

4,356. Electric Incandescent Lamps and Reflectors used therewith. A. F. Berry. March 26th, 1917. (114,336.)

7,683. Electric Plug Couplings. W. T. Henley's Telegraph Works Co. and W R. Clements May 29th, 1917. (114,363.)

8,109. Electric Switches. M. J. Quinn. June 6th, 1917. (114,365.)

8,446. Electric Sparking Plugs. A. A. Scott. June 13th, 1917. (114,368.)

8,992. Rubber-insulated Electric Cables or Conductors. E. A. Bayles and British Insulated & Helsby Cables, Ltd. June 22nd, 1917. (114,373.)

14,206. Metal-plate Structures. Quasi-Arc Co. & W. L. Cole. October 2nd, 1917. (114,394.)

14,455. Electric Pulley Blocks H. B. Smith & Electric Pulley Block Co. October 6th, 1917. (113,415.)

15,722. Holders or Fittings for the Electrodes of Electric Furnaces. J. R. Hoyle & P. Fawcett. October 29th, 1917. (114,395.)

16,914. Means for Lubricating the Fibre Sleeve of the Interrupting Lever in Magnetos having a Stationary Armature. E. C. R. Marks (Soc. Anon. des Etablissements L. Blériot). December 18th, 1916. (Divided application on 18,144/16.) (113,586.)

17,044. Electric Motor Meters. Landis & Gyr Akt. Ges. December 2nd, 1916. (111,848.)

17,045. Method of Working Refractory Metals. Westinghouse Metal Filament Lamp Co. (Westinghouse Lamp Co., U.S.A.) November 19th, 1917. (114,282.)

17,874. Process and Means for Connecting Cables or Wires. R. A. Bousson. September 14th. 1917. (114,405.)

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MANUFACTURERS PREPARE FOR THE RECONSTRUCTION PERIOD.

As our readers are fully aware from our various articles on the subject, we have followed as closely as human and war-time limitations will allow the multitudinous, multifarious, and ever-extending investigations and conclusions of the Ministry of Reconstruction. We recognise that whatever may be the state of affairs at this moment, there will come a time when immense changes must necessarily be made within a comparatively brief period, changes the like of which we have never witnessed before, and probably never shall do again in our lifetime. The war changes that have taken place affecting the industrial and common life of the people have been spread over a period of nearly four years. We have tried to accommodate ourselves to them stage by stage as each new war development has rendered them necessary. It will be more difficult, and possibly dangerous, when we try to get back as quickly as possible to approximately normal conditions. We cannot leave things to take their chance, therefore we do not join in the occasional popular jibe at a Ministry of Reconstruction and its host of committees, for we recognise that there is room for men of vision and foresight in directing our investigations in order that we may be as fully prepared as we reasonably can be for an entirely altered state of things.

We believe that Dr. Addison has so far performed his task very satisfactorily. We say "so far," because we do not believe that it is his intention to remain in charge of these operations as a practical administrator of the projects that his many committees have advanced, or will yet produce. But at present he is in charge of a vast variety of deliberations which, taken as a whole, are destined to have a great influence upon the life of the nation, in all its parts, in the approaching years, and the manner in which he is performing his task is one for congratulation rather than for unfriendly hypercriticism. It were a thousand pities to concentrate upon winning the victory over Prussian militarism unless we are going to fit ourselves for assuring to the nation the minimum of hardship in the days when the world is free. Long suffering is bound to follow the war, but we may reduce it by taking appropriate action during the war—keeping industrial and national disorganisation at the minimum, and being ready for the new conditions immediately they arise.

Yet, while we have said all this, we do not for one moment pin our faith for the future entirely to the works of a Ministry of Reconstruction, nor do we put our whole trust in legislation which may ensue as the outcome of the investigations of innumerable committees. Paul, in the person of Dr. Addison, may plant, Apollos, in the shape of Parliament, may water, but it is Industry which will give the increase which shall assist us all in the critical days of Peace. We hope that we shall not be misunderstood when we say that we are disposed to attach greater value at the moment to the practical measures that our industries themselves are taking than we do to committee deliberations. The latter are essential, but the former are absolutely indispensable unless the reconstruction seed is to fall into quite impoverished soil; indeed, perhaps it would not be far wrong to say that the two efforts are really very closely related, for what the manufacturers are doing in the way of reorganisation in readiness for progressive and extended industrial activity is the carrying into effect on their own initiative of some of the principles which, separately considered, have found favour in Government committees.

In referring last week to the findings of the Lord Balfour Committee we showed, as we have done again and again during the last few years, that Germany, by declaring war and making us self-dependent, afforded us such opportunities for revising our industrial arrangements and recovering manufacturing ground that we had previously thoughtlessly allowed to be taken from us by penetrative and other measures, as there was no prospect of our having otherwise. Many British manufacturers have availed themselves of the opportunity to the full, and British industry and trade, British workers, and British stability should feel the effects of it for many a year, if the advantage is not frittered away at the Peace Table. There is material available for a long practical series of articles or a valuable book, devoid altogether of padding, showing the altered aspect of industry to-day compared to four years ago. The plans prepared in manufacturing offices, the changed and changing character of the output of the works, and many other things, could be requisitioned to pay their own testimony, if one only had the time, the facility, and the permission to tell the whole story. Part of it was told in the presidential address to the I.M.E.A. last year, where we found achievements of electricity in new industry sufficient to make the heart rejoice. Another part of it is told in the statements of individual manufacturing companies connected with the electrical and allied engineering trades, and part in the reports on operations of co-operative associations. But we do not think that we have come across any chapter of such immediate practical value, and of such substantial character as that which was put before the shareholders of Messrs Vickers, Ltd., at their annual meeting, held at Sheffield on April 25th.

We have witnessed many a piece of practical industrial reconstruction work in the electrical world during the last four years in the doings of well-known manufacturers. The joint action of battery makers in one connection; the co-operative trade-getting policy adopted by a number of motor and switchgear makers in the Russian market; the consolidation arrangements of Dick-Kerr, Willans and Robinson, United Electric Car, and the Phœnix Dynamo Co., with one commercial organisation for the whole; the purchase of a controlling interest in Fraser & Chalmers, and sole interest in Chamberlain & Hookham, by the General Electric Co., Ltd., which has for years had its own extensive network of selling companies in most of the markets of the world—these are a few of the things that occur to us as we write, as events likely to have a considerable bearing in the altered conditions of home and world trade in the future. But most recently of all are we impressed by the far-reaching operations which are to take place in connection with the manifold and world-wide operations of Messrs. Vickers, and the projects of the British Westinghouse Co., in which they, too, are now directly interested. Mr. Vickers states that his company had long intended to build a large electrical manufactory outside Sheffield, but instead of doing so they have entered into an arrangement under which they are associated with the Metropolitan Carriage, Wagon & Finance Co. in the control of the British Westinghouse Under present-day and prospective conditions it would take a long time to get a new factory into working order, so the intention, apparently, is to take advantage of the war-time factory extension at Trafford Park instead of starting new operations at Sheffield, the changes at the latter place being limited to an increase in the policy of specialisation. The Vickers peace industry programme is, however, a far larger thing than this. At a certain factory where 7,000 machines now serve mainly to manufacture automatic guns, 1,700 machines will be turned over to the production of sewing machines, giving, it is expected, a very considerable output within a few months of the end of the war; some are already being made at their other works, and the demand is in excess of the supply. From automatic guns to sewing machines sounds something like from swords to ploughshares, but the process is typical of many a coming change in our works. Mr. Vickers, like some other people, obviously cannot see the end of all war until human nature is changed, for he is not proposing to swing right over to peace manufacturing without giving a thought to other possibilities. It may interest Dr. Walter Rathenau, who once spoke so buoyantly about preparations for the next war, to note that Mr. Vickers advocates that a large part of the present war plant in their factories, which will be unusable for ordinary purposes, should be taken up and stored in one of their big buildings "ready for use in case Germany attacked us again." At another works, in the South, Messrs. Vickers propose to manufacture on a large scale certain semi-electrical devices for motor cars which are thought to have a wide application; also speed-controlling apparatus developed for war, but adaptable for marine work; and at the same place there will be made certain types of machine tools of a class hitherto mainly imported. Further, at a factory on the Thames a wood-working organisation is being established which apparently originated in a method of utilising waste products from war-work, but which presents possibilities of profitable expansion. Magnetos will be manufactured on a large scale, and the new light alloy "Duralumin," at Birmingham. The older Vickers trades at Sheffield are also the subject of an ambitious programme, and at Barrow we shall witness greatly increased activity in mercantile shipbuilding, while the manufacture of land boilers and large gas engines also will be proceeded with there, the company having its eyes open to work that is likely to be required for the large electric power supply schemes that are practically certain to come along.

We believe that this summary of one great concern's intentions and operations in preparation for peace-time industry will impress our readers as it does us. We have no doubt that other big manufacturers connected with the electrical and engineering, and iron and steel trades, have ambitious programmes awaiting execution. Perhaps they, too, will divulge them in course of time. Little help can go to the enemy from thus disclosing intentions; nobody knows better than he what he has to come up against; on the other hand, it would make for our encouragement at home, and for safety by preventing unnecessary overlapping, if British manufacturers were able to know a little of what other firms had in mind. That is not possible if we are going to continue unrestricted competition between ourselves at home; it *is* possible if we act in co-operation, and try to co-ordinate our efforts.

We quote Mr. Douglas Vickers's speech with this prominence because the plans outlined afford an excellent example of practical work which can be, and is being, done *by industry itself* in preparation for the period of reconstruction.

Whitley Reconstruction.

Once more we desire to bring before industrial readers the desirability of taking steps to set up for the industries which we represent industrial councils along the lines laid down in the several Whitley reports. We understand that many such councils are now in process of formation, but in certain industries, for a variety of reasons, progress has been slow. In such cases, pending the formation of Industrial Councils, it is important that there should be established Interim Industrial Reconstruction Committees consisting of equal numbers of representatives of organisations of employers and trade unions. Perhaps we know less now than at any previous stage of the war when it is going to end, but we may be able to avoid much serious trouble if we try in time to take such steps as these in order to smooth the way for the transition from war to peace conditions. Such interim committees can consider such matters as the promotion of industrial organisation, demobilisation and employment, raw materials for manufacturing industries, priority in respect of such materials, financial facilities for converting works from war work to normal production, and the development of new industries, which, as we have recently indicated, is being investigated by the Engineering (New Trades) Committee. The matter is set forth in useful detail in a new memorandum issued by the Ministry of Reconstruction, to which we would direct our readers' attention. The following is a specimen draft of an Interim Committee:—

1. The Interim Industrial Reconstruction Committee for the .... Industry promoted by the Minister of Reconstruction, the President of the Board of Trade, and the Minister of Labour will consist of equal numbers of representatives of Associations of Employers and Trade Unions.
2. The Committee shall elect a chairman either from amongst its own members or from outside. In cases where no agreement can be come to with regard to a chairman, the Minister of Reconstruction will, at the request of the Committee, appoint a chairman.
3. The Committee shall take steps to provide itself with a secretary, and a place of meeting, but during the preliminary stages may, if desired, meet at the Ministry of Reconstruction, who will provide temporary secretarial assistance if desired.
4. The functions of the Committee shall be those set out in the Memorandum circulated with the letter of invitation.
5. At least one week's notice shall be given of meetings which shall be called by the chairman or by the secretary at his request.
6. The Committee will cease to exist on the formation of a Joint Standing Industrial Council on the lines recommended by the "Whitley" Committee.

As we have already explained, these Interim Committees will serve as an intermediate stage in industrial organisation in the case of industries wherein the degree of organisation is insufficient to admit of the immediate formation of a full Whitley Council. They will be a kind of stepping-stone whereon industries or trades may rest for a moment to consider the more urgent of the problems of reconstruction. It will be a great mistake to leave such matters to take care of themselves, or to wait for the Ministry itself to take definite action, though it has already approached a number of trades with successful results. The movement would proceed with greater expedition if our industrial readers would think the matter over for themselves and work out the necessary preliminaries.

British Manufacturers in Australia.

We wish to direct attention to the report of the annual meeting of the Australian Association of British Manufacturers and their Representatives which appears on another page of this issue. We believe that the very comprehensive speech of the chairman, Mr. M. C. Coates, will be read with interest by all at home who are watching the efforts of those who, under exceptional difficulties, are doing their utmost to keep the British trade-flag flying. The import figures for the year 1917 show what is happening, and we do well to assist our kith and kin out there who desire to regain the lost ground immediately the war pressure on the home factories is reduced. The Association showed a remarkable growth during the year, and we pass on to British firms not already on the roll the appeal that they should throw in their lot with those who reasonably expect to find in unity a great strength for the days to come.

Electricity in Ship Propulsion.

Elsewhere in this issue we give an abstract of a paper on the electrical equipment of the new U.S. battleship *New Mexico*; this, the largest unit in the U.S. Navy, will be propelled entirely by electric motors, fed from turbo-generators of 37,000 h.p., and all the auxiliaries will also be electrically driven. Not only will the machinery be lighter and cheaper than either mechanically geared turbines or reciprocating engines—it will also be more efficient, as shown in our abstract, the steam consumption being guaranteed under heavy penalties. This startling step in advance is largely based upon the success of the U.S.S. *Jupiter*, which was equipped with electrical propulsion expressly as an experiment; it bears witness to the complete confidence of the U.S. naval authorities in the reliability and economy of the electric drive, for no one would venture to make doubtful experiments with a 32,000-ton battleship, least of all in time of war. We hardly need add that we share that confidence. In point of fact, there is nothing experimental in the whole equipment. Turbo-generators, motors, and controlling gear have all been fully tried out in stationary service, and there is no reason whatever to suppose that they will prove wanting at sea, provided that due regard is had to the working conditions that obtain on board ship.

Our only regret is that the British Admiralty (so far as we know) has not yet seriously contemplated a similar forward step. Before the outbreak of war one or two cruisers had been fitted with electrically-driven auxiliaries, including the operation of the big guns, but the innovation was too daring for the conservative minds of the older men, who didn't hold with such new-fangled notions, and took the first opportunity to revert to hydraulic gear. We are reminded of the days when the electric telegraph was offered to the Admiralty, but rejected on the ground that the semaphore system fully met all requirements; as in that case, so in the present, the decision bore no relation to the merits of the apparatus, which was simply sacrificed to service traditions. As to what has been done since the outbreak of war, we have no information; all that we can positively affirm is that, also in accordance with tradition, our glorious Navy has preserved our shores inviolate, and done its duty under all circumstances with an heroic disregard of danger for which language provides no adequate eulogy.

It was, however, in this country that the electrical propulsion of ships first received serious attention; the late Mr. Henry Mavor's name cannot be here omitted, and the inventions of Mr. (now Lieutenant) Durtnall, who claims that his system was adopted on the *Jupiter*, must also be recognised. While, unfortunately, these pioneers were not fated to achieve the goal of their ambition, we are glad to know that their work has borne fruit, for we were privileged last week to inspect the machinery of a steamship of 6,000 tons, whose propeller is driven by electric power derived from two turbo-generators. This, we believe, is the first British sea-going steamer to be so propelled; and we congratulate the British Ljungström Marine Turbine Co., the contractors, as well as the Brush Electrical Engineering Co., the manufacturers of most of the plant, on their achievement, which we hope is only the first of many, and will have a long and prosperous career. The turbine, which is without doubt the most interesting type of turbine that has been developed, has given a good account of itself in many British power stations, and there is no reason to doubt that the new departure will prove wholly successful in respect of economy, reliability, and cost.

INCOME-TAX: WEAR AND TEAR AND OBSOLESCENCE ALLOWANCES.

By JOS. J. H. STANSFIELD.

A memorandum has just been issued by the Board of Inland Revenue on the subject of allowances for wear and tear and obsolescence of plant and machinery, a subject which is of importance having regard to conditions brought about by the war and the increase in the rates chargeable for income-tax.

Sec. 12 of the Customs and Inland Revenue Act, 1878, authorises a deduction in assessing the profits of any trade, manufacture or concern in the nature of trade chargeable under Sec. "D," or by reference to the Rules of that Schedule, of such an amount as the Income-Tax Commissioners "may think just and reasonable as representing the diminished value by reason of wear and tear during the year of any machinery or plant used for the purposes of the concern." In addition to this deduction an allowance is made in respect of the cost of repairs, but any claims under this Section must be made within 12 calendar months after the expiration of the year of assessment.

Sec. 26 of the Finance Act, 1907, provides that claims made for deductions for wear and tear to be allowed by the additional Commissioners shall be included in the annual statement of the profits or gains required to be delivered under the Income-Tax Acts.

There is no statutory limit to the amount which may be allowed, but the aggregate amount of the deductions must not exceed the actual cost, including in that actual cost any expenditure in the nature of capital expenditure by way of renewal, improvement, or reinstatement.

Where full effect cannot be given to the deduction for wear and tear in any year owing to there being no profits or to the profits being less than the deduction; the deduction to which effect has not been given shall be added to the deduction for or allowed from the profits of the following year, and so on for succeeding years until the deduction has been fully made.

Definite rates of depreciation on different classes of machinery have been agreed upon in a number of important industries, and it is stated that these allowances are now accepted by taxpayers and generally adopted. A list of these rates is given in the Memorandum, the following being of interest to those engaged in the electrical industry:—

Electric Light Undertakings.—3 per cent. on written down value of cables and 5 per cent. on plant and machinery.

Gas Undertakings.—Other than those owned by municipal or other public authorities 3 per cent. on gasholders and 10 per cent. on meters, cookers, and gas fires.

Motor-Omnibuses.—20 per cent. on written down value, but the rate is to be reconsidered at the expiration of four years, commencing with 1916-17. This rate does not apply to commercial motor vehicles.

Railway Wagons.—5 per cent.; this applies to all wagons owned by traders; but, in the case of railway companies, the method adopted is to allow the actual cost of renewals year by year.

Tramways.—Permanent way, an allowance per mile of track based upon the estimated life; 3 per cent. on cables, 7 per cent. on cars and other rolling stock, and 5 per cent. on renewal of plant and machinery, including standard brackets and workshop tools.

With the exception of the rates relating to omnibuses, all the above rates were fixed under pre-war conditions; but cases have arisen during the war in which machinery is suffering exceptional wear and tear owing, for example, to extra hours of running, the difficulty of obtaining material for effecting repairs, rougher usage through the employment of unskilled labour, or fewer opportunities of overhauling.

In such cases applications for special rates are entertained, but the circumstances of the individual vary so widely that a uniform scale cannot be fixed, each one being dealt with on its merits.

In addition to the allowances above mentioned, there has been in operation since 1897 an allowance for obsolescence (see letter of the Chancellor of the Exchequer of May 28th, 1897, to the Association of Chambers of Commerce). When new or improved machinery is introduced in place of machinery not wholly worn out, the Board of Inland Revenue agrees to allow so much of the cost of replacement as is equivalent to the written-down value of the machinery replaced, less any sum realised by the sale of it, the balance of the cost of the new machinery being treated as an addition to capital. This allowance is not, in practice, made unless there is replacement, it being considered that otherwise the loss is a loss of capital, and, therefore, not allowable.

As an alternative to the allowance for wear and tear and obsolescence, the cost of renewal may be claimed, and when this is preferred the amount to be allowed is the actual cost of the new plant and machinery (excluding any part of such cost which is attributable to additions or improvements *i.e.*, to increase in capital) after deducting the scrap value or realised price of the plant and machinery replaced.

Buildings and wasting assets are not allowed for, but the full cost of maintaining trade premises in proper working order is allowed in computing profits for assessment.

In controlled concerns under the Munitions of War Act, 1915, the income-tax allowance has been temporarily extended by the Finance Acts, 1916-17, to include exceptional depreciation or obsolescence of buildings, plant, or machinery, which are allowed for Excess Profits Duty and Munitions Levy purposes. This allowance is to prevent the hardship that would otherwise arise owing to the circumstance that controlled establishments being held at the disposal of the Government may be required to alter completely the course of their business, and to undertake exceptional expenditure which may be of little or no post-war utility to them.

Sec. 39 of the Finance Act, 1916, and Sec. 16 of the Finance Act, 1917, authorise the Commissioners to revise the income-tax allowance, so as to enable a deduction to be made from profits of the difference between cost and post-war value of installations and extensions (including buildings) which would not have been undertaken but for the war and the express requirements of the Government.

The Board of Inland Revenue is open to consider allowances in respect to excess profits duty for deferred repairs though a definite scale has not been laid down. The method adopted is to take current expenditure on repairs, and allow the difference between previous expenditure, with an additional sum for increased cost.

LARGE BATTERIES FOR POWER PURPOSES.

By E. C. McKINNON, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 414.)

Maintenance agreements in the past have been to a certain extent a cause of irritation and dissatisfaction mainly because there has been no generally accepted standard, and many engineers have regarded the agreement as an insurance to cover all ill-treatment, in addition to the essential object which is the maintenance of the battery in good working order. If a recognised standard maintenance agreement approved by this Institution were available, negotiations would be greatly simplified.

There has so far been very little experience with batteries working at a line pressure higher than 600 volts in this country. When the Lancashire and Yorkshire Railway decided to employ direct current at 1,200 volts for the electrification of the Manchester-Bury section of their system—a length of 9½ miles—it was necessary to go abroad to study similar schemes. The most instructive—from the battery section—was the electric railway between Stockholm and Saltsjöbaden, a distance of 9½ miles. There the system is a direct-current one at 1,200 volts with overhead conductors, and includes a buffer battery of 650 cells with a rated output of 666 ampere-hours in one hour, which represents 800 KW. at the one-hour rate. The battery is employed for the double purpose of levelling up the line load variations in conjunction with a reversible booster, and also as a capacity battery for lighting and power purposes. The dry Swedish climate tends to simplify the question of insulation. The cells are of the ordinary central-station type, the only difference being the doubling of the insulators. The gangways are mounted on high-tension insulators; the walls and columns of the battery room are screened with a lattice-wood structure mounted on insulated brackets; the lamps are hung out of reach; and the battery inspection lamps are fitted in special ebonite carriers and connected by flexible conductors in a "cab-tyre" sheathing. The battery is sub-divided into several sections by means of link connectors. The battery is on two floors, the lower one being treated as an ordinary 600-volt traction battery room, and the upper one being regarded as a high-tension chamber securely locked. Special instructions are issued regarding operations in the high-tension room.

There are two battery sub-stations on the L. & Y. Railway. Each battery consists of 580 T.P.W. 5/8 Plantide cells supplied by the Chloride Electrical Storage Co., Ltd. Each battery is divided into a low-tension and a high-tension section, *i.e.*, equivalent to two batteries placed in series. The low-tension section is constructed as an ordinary 600-volt traction battery, whilst the high-tension section is dealt with on very similar lines to those described in the Swedish system. The working of the batteries is normally controlled by Entz automatic reversible boosters.

A description of most of the notably large batteries in this country has been given in the electrical Press, or in papers read before the Institution. In all the batteries the positive plates are built on the Planté principle.

The battery at the Eagle Street sub-station of the Metropolitan Electric Supply Co. may be regarded as the acme to date of the special Planté type, while the batteries at Manchester, Bradford, Birmingham, and Wolverhampton represent the latest practice in true Planté batteries. The Eagle Street* battery comprises 110 "Chloride" cells, C.V.W. 26 type, but the sub-station is designed with the intention of duplicating the battery at some future date. The total weight of the battery is about 300 tons, and it is capable of discharging at 8,000 amperes for 35 minutes, or 15,000 amperes momentarily.

A Planté plate must be given fairly constant work or its condition will deteriorate. The Faure or pasted plate, on the other hand, will endure long periods of idleness without suffering any permanent after-effects. By a fortunate coincidence it is possible to obtain far more capacity for unit weight and cubic contents from a Faure cell than from a Planté cell. A cell of the Faure type is therefore eminently suitable for stand-by purposes. Its durability is inferior to that of Planté cells, but as it is possible to obtain 300 to 500 discharges from one set of plates this should amply cover emergency requirements for a period of 10 years.

The Exide negative plate is not unknown in central-station work in this country, as one set operated in daily use for 8½ years (1905 to 1913) in the large battery at the Fisher Street sub-station of the Metropolitan Electric Supply Co. For extensive practical results we must, however, still refer to the United States.

The largest stand-by battery installed in the United States up to the time the data were collected for this paper was at Detroit (Mich.). The maximum peak load during the winter of 1915-1916 occurred at 5 p.m. on December 17th, 1915, and amounted to 55,700 amperes at about 134 volts on each side of the three-wire system. The combined capacity of the four batteries installed will carry this load for 14 minutes. One battery alone consists of 150 "Exide" cells, type H. 169, installed in 1915, with a capacity of 25,200 amperes at 110 volts for one hour, or 80,000 amperes for 10 minutes.

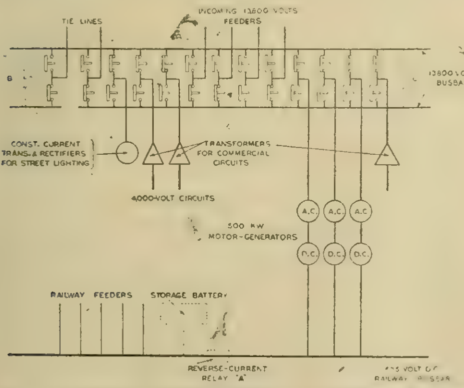
INCOMING 13800 VOLTS FEEDERS
TIE LINES
13800 VOLT BUSBARS
CONST. CURRENT TRANS. & RECTIFIERS FOR STREET LIGHTING
TRANSFORMERS FOR COMMERCIAL CIRCUITS
4000-VOLT CIRCUITS
A.C.
A.C.
A.C.
500 KW MOTOR-GENERATORS
D.C.
D.C.
D.C.
RAILWAY FEEDERS
STORAGE BATTERY
REVERSE-CURRENT RELAY "A"
575 VOLT D.C. RAILWAY BUSBAR

Fig. 2.—Stand-by Battery Applied to Alternating-current System.

Normally a stand-by battery floats on the supply system, regulating momentary fluctuations and in readiness for peak and emergency discharging, the adjustment being such that during the floating period the total amount of charge compensates for the discharge. The battery should be floated so that the pressure per cell in circuit will be between 2.10 and 2.14 volts, averaging as near as practicable 2.12 volts. Adjustment is made by cutting in or out end cells.

The installation of a storage battery for stand-by service on an alternating-current circuit presents no insurmountable engineering difficulties, and an interesting example of such an application is found at the Newton sub-station of the Edison Electric Illuminating Co., of Boston (Mass.). Power is received at 13,800 volts, three-phase, 60 periods, over duplicate transmission lines, a distance of 12 miles. The sub-station supplies three classes of service, viz.:—The local commercial load of lighting and power supplied to the distribution feeders at 2,300/4,000 volts, four-wire, three-phase; series arc lamps for street lighting; direct-current at 575 volts for operating the suburban electric railway in the district.

The original arrangement of the apparatus in this sub-station is shown in fig. 2 in full lines, while the apparatus added in connection with the battery installation is shown in dotted lines. The diagram is conventional, and shows only one phase of the three-phase circuits, and one side of the direct-current railway circuit. Duplicate high-tension bus-bars are provided, and duplicate oil switches for each incoming and outgoing circuit permit each circuit to be connected at will to either set of bus-bars. Step-down transformers furnish the 2,300/4,000-volt current for the local commercial load. Constant-current "tub" transformers with mercury-arc rectifiers are used for the street lighting, and three 50-kw. motor-generator sets furnish the 575-volt direct current to the railway bus-bars. Each of these units consists of a 13,800-volt synchronous motor direct-connected to a 575-volt interpole direct-current generator.

An "Exide" battery consisting of 344 cells, type H. 31, having a capacity of 2,250 amperes for one hour, or 4,650 amperes for 20 minutes, has been installed. During normal operation the battery floats directly across the railway bus-bars, which are maintained at a substantially constant voltage, so that the battery is doing no work. In case of any trouble on the high-tension distribution system of sufficient magnitude, the battery takes up all of the railway load and feeds back through motor-generator sets into the local alternating-current circuit, but not into the entire high-tension distribution system.

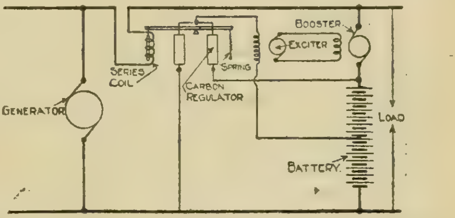

Fig. 3.—Diagram of Connections for Entz Control.

In order to ensure constant voltage during emergency discharges, the battery is provided with motor-operated end-cell switches automatically controlled by a contact-making voltmeter connected across the battery terminals.

Large batteries in this country all show results which prove that the practicability of very large batteries is assured.

The principles on which large batteries are controlled have not changed materially during recent years, but the policy adopted in practice has undergone an appreciable change. It remains a recognised fact that without some means of variable voltage regulation the amount of useful work to be obtained from the battery is very limited. To effect this regulation the choice lies between end-cell switches and boosters. Continental practice is solidly in favour of end-cell regulation. Until five years ago American practice favoured automatic boosters for almost all purposes, but now the trend in the United States is to employ motor-driven end-cell switches where the battery is used for lighting service (on peak work or for stand-by service), and automatic reversible boosters only where the control is required for rapid momentary fluctuations.

In this country boosters have so far formed the predominant method of controlling large batteries, despite the strong aversion on the part of some British manufacturers to build these special machines. There is undoubtedly much to be said in favour of booster control for even the largest batteries which have so far been installed in this country.

The Entz booster still holds a strong claim for superiority in all classes of heavy load regulation. Fig. 3 shows diagrammatically the connections for the Entz booster control. The battery is connected across the feeder bus-bars and in series with the generator armature of a motor-generator or booster set. The booster has its fields energised by an exciter, the field of this exciter being varied in a positive or negative direction by current from carbon piles connected to either end of the battery. These piles are depressed through the action of a coil in the main generator circuit opposed by a spring, as indicated in the diagram. When the load is at the average, the coil and spring neutralise each other's action, and the carbon piles have an equal amount of current in them. When the load fluctuates above the average, tending to call for more current from the generator, this increase of current in the coil overpowers the spring and the carbons on one side are compressed, energising the booster field in a direction to add to the voltage of the battery, thus causing it to discharge. On this discharge the battery voltage drops due to its internal resistance and polarisation, and the carbon regulator, being extremely sensitive, so adjusts the booster voltage that the battery discharge plus the average load equals the outside load. On fluctuations below the average the load on the generator tends to drop and the spring overcomes the coil, the battery receiving a charge equal to the difference between the average and the outside load. The Entz system has been applied successfully to alternating-current regulation as well as on direct-current service.

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* See Elec. Rev., April 21st, 1916.—Eds.

The cell switch is a vital part of the stand-by battery installation. Its importance can hardly be overestimated. Unless this part of the installation is absolutely reliable and capable of handling the battery output under all conditions the value of the battery as an emergency reserve is seriously impaired. The continuous rating of the end-cell switches should correspond to the one-hour rating of the battery. The overload capacity of the switches is then sufficient to handle any output which the battery can furnish. It is usual practice to install two or even three cell switches on each side of a three-wire battery.

The British-made end-cell switch as supplied by Messrs. Bertram Thomas is a remote-controlled regulator fitted with a lead-saving device shown diagrammatically in fig. 4. The switch arms A A are moved simultaneously by the motor B, which is started and stopped by a combined switch and indicator. By moving the switch handle E on to one of the two contacts F and G the coils of one of the two small contactors are energised, and this operates one of the direction switches L and M, thus energising the motor in the necessary direction to drive the battery switch to cut cells in or out. During the movement of the switch arms A A the four circuit breakers C are operated by cams, so that during the travel from one contact to the next the auxiliary or jockey cells are brought into operation, as also the pilot resistance D which is introduced to prevent short-circuiting of cells.

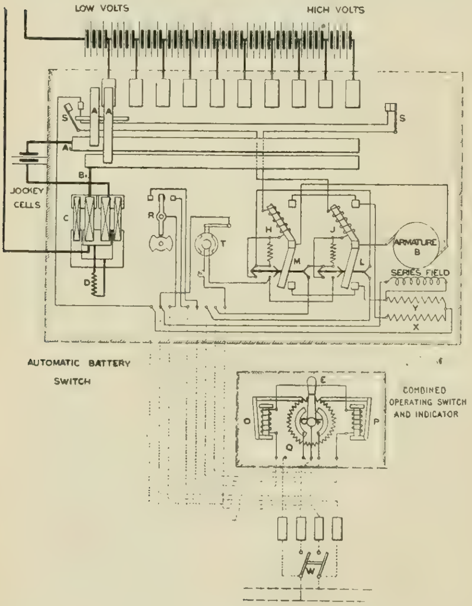

Fig. 4.—End-cell Switch Connections (Bertram Thomas Pattern).

All making and breaking of circuit and changing from one cell to the next takes place on the four circuit breakers C. The two racking contactors O and P on the combined switch and indicator operate on a ratchet wheel Q. The coils of these two contactors are energised by the auxiliary switch R, which is in turn operated by the battery regulator, and makes contact in one or the other direction with each complete step traversed by the battery regulator. On each occasion the switch R makes contact it energises one of the contactors O or P, and this in turn racks the centre wheel of the indicator round which carries the contacts F and G. The battery switch continues to travel, and the contactor repeats the racking motion until the gap in the contacts comes opposite the handle E, at which point the battery regulator stops. When once an operation has been initiated by the operating switch E, the direction switch L or M, as the case may be, is held closed until the completion of a step by means of the auxiliary switch marked T, which is mounted on the regulator shaft, and energises the contactor of the direction switch independently of the operation switch as long as the regulator is between two steps.

Many of the batteries originally installed in American stations for daily peak work are now merely held in reserve for emergency service. This has led in some cases to the battery being discarded when the existing set of plates has worn out, but in most other cases the batteries have been renewed with plates of stand-by pattern; in fact this practice has become quite general in large central-station batteries for lighting service.

Discussion at Leeds.

The paper was discussed at a meeting of the Yorkshire Local Section at Leeds on February 12th, 1918.

Mr. R. H. Campion (Dewsbury) remarked that the question whether a battery should be installed or not on continuous-current systems often hinged on considerations other than the first capital cost, and the load was taken by the battery, but he did not think that it was possible to do this now in any fairly large station. The big batteries installed in England were not capable of taking the whole load for even a period of five minutes. Therefore there came a time when either the maintenance contract or the battery required renewal, and when the question arose as to whether it paid to have a battery. If one was to be guided by the 10 obstructing factors set forth by the author he was afraid that in most cases batteries would not be installed. A sphere in which batteries were useful and profitable was that of taking the peak loads of traction work, and if it were not for the reversible booster they would have to be stricter with the agreed-upon maximum demand that was taken. They must leave the question of standardisation to the makers, and he thought this should be easier now owing to the recent amalgamation of battery makers. With regard to specifications, he considered that it would be a great advantage to standardise and revise them every three years.

Mr. T. Roles said they had a very large battery in use at Bradford which, from all he had heard, was operating successfully. With regard to the obstructing factors to the use of batteries in this country mentioned by Mr. McKinnon, he must say that personally he had that "irreconcilable prejudice." Concerning the difficulty of providing the necessary capital, it needed a wealthy corporation to even consider the installation of a battery. The Local Government Board decreed that the capital expended had to be repaid during a period of seven years. The battery makers guaranteed a battery for 15 years, so that, in addition to paying the maintenance charges, the users had to pay one-seventh of the cost of the battery for seven years, and the odds were that the undertaking would show a deficit for seven years. It was a difficult matter to accommodate large batteries on existing sites. He could quite imagine the inadequate training of engineers had had a very obstructive effect on the installation of large batteries in medium-sized undertakings. As to the floor upon which to place the battery, he had always inclined to the use of asphalt.

Mr. W. M. Selvey said the question of policy was the point they were all interested in. In the early days batteries were used in all sorts of ways for levelling up load, but to-day it had come down purely to a question of stand-by. In order to take full advantage of bulk supply they had to put in a big stand-by battery as an insurance. If that was so, it was one of the most serious statements in the paper. He agreed that they would always require batteries for some purposes, but the idea that they would have to become general for the bulk-supply system was certainly somewhat new to him.

Mr. W. H. Brown said the matter which chiefly interested owners in connection with the installing of batteries as a stand-by was the question of initial expense. The question of obtaining distilled water, too, might be a difficulty. One got from the makers a certain guarantee where the discharge capacity was based on a five-hours' rating, and he was informed that in the West Riding of Yorkshire that sort of thing was not of much use, the heavy discharges would run the battery out in much less than five hours. A further point was the lack of information with regard to batteries. He had often been told that there was a great difficulty in getting a book which dealt with batteries. As one who was hoping in due course to do away with small installations in favour of bulk supply, he was much interested to know that batteries were being used to secure continuity of supply. He certainly thought no kind of bulk-supply station would run, no matter what the supply was, without the supply being more or less frequently interrupted.

Mr. R. D. Spurr pointed out that suitably proportioned chimneys would draw off the gases, and provided the air inlets were at the floor level, and were well distributed, all dirt and grit would tend to settle on the floor, where it could be easily washed away without causing any dust. Fans were unsatisfactory as they created strong draughts and became corroded. The life of a battery would be better expressed as the total number of complete discharges and charges that constituted its life, say at the five-hour rate, and users could then form a better idea of the useful life remaining at any time by deducting the number of discharges from the total rated life. With regard to channel bars, those at present in use were too rigid, and they should be made of a deeper inverted U section to allow for the working that was constantly taking place. Specially designed insulators should be freely used between the cells, so that one supported the others, and they should be made cylindrical, not less than 4 in. diameter, and perfectly smooth except for a single collar in the centre. With regard to floating batteries, too much floating resulted in very inefficient working. A battery should be discharged and charged at least three times every week to obtain a reasonable return for the capital expended on it.

Mr. J. C. Shaw was of opinion that the most important part of the paper was that dealing with the future aspect of storage batteries. He thought, however, the author had been a little unhappy in selecting America as a guide. He believed that with the proper interlinking of power stations and the use of batteries they could give an absolutely continuous supply. One speaker had said they must get a full output three times a week from a battery, but he (Mr. Shaw) believed that to make it pay they must get a full output twice a day.

Mr. Broekman said Mr. Shaw's contention that a battery had to be discharged twice a day was rather exaggerated. He personally was in favour of booster control.

The President pointed out that Mr. McKinnon had said: "Lead-covered cables are cumbrous," and that "the most satisfactory form of protection is lead covering with the further protection of a coat of grease or paint." He thought, in the first place, Mr. McKinnon meant lead-covered vulcanised cable, and in the second case the lead covering of copper conductors which could be used without any insulating covering whatever.

Mr. McKinnon, in reply, said with regard to channel bars being too rigid, they must remember that the bar was simply connecting up two plates. There was no continuous strain from one end to the other of long rows of batteries. Battery makers recommended a discharge once a week for a stand-by battery. Mr. Shaw had given the impression that the makers were suggesting that they should do the standardisation. He, the author, had suggested that the Institution should make the standardisation, and the makers fall in line.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Westinghouse Lighting Dynamo for U.S. Military Motor Wagons.

A feature of the standard design of military petrol motor wagons adopted by the U.S. War Department is the provision of an electric lighting set. To meet the arduous work such vehicles are likely to be subjected to, the Westinghouse Electric & Manufacturing Co., of Pittsburg, have recently introduced a specially-designed, cam-regulated generator. Although it is capable of developing a continuous output of 12 amperes at 7·5 volts, the machine is ordinarily adjusted at the factory to give a voltage not greater than 8 volts at 1 amp. output, at speeds up to 2,000 R.P.M., and with a load of 15 amps. to give not less than 7 volts up to the same speed. In general appearance the machine is similar to other generators of Westinghouse manufacture, the frame being made from circular-section steel tube which lends itself to cradle mounting on the engine. The end brackets may be extended to form flanges for end mounting, in which case the cradle brackets are not required. The construction of the armature shaft and regulated generator parts follows the customary lines: the windings are strengthened both mechanically and electrically by a double impregnating treatment which renders them oil and water proof. Four brushes are provided on the machine in place of the usual two, and the field coils are securely located on the poles and highly insulated, the lighting set working on the single-wire, earth-return system.

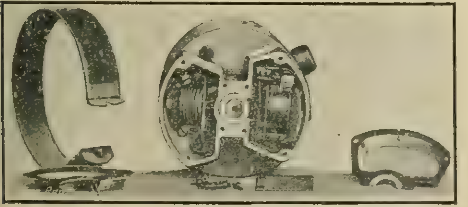

Fig. 1.—End View showing Cut-out Switch and Regulator.

It is in the cut-out switch and voltage regulator, fig. 1, that the apparatus differs from other types. The cut-out and regulating units are mounted within the bracket on the commutator end; the cut-out is on the left and the regulator on the right, removable covers being provided to give access to both. The cut-out is adjusted to close the circuit to the battery when the speed of the generator reaches such a point as to give a pressure of 6·5 volts at the generator terminals; it opens with a reverse current of one ampere and at a speed below the cut-in speed to avoid any tendency to chatter when the generator is running near the cut-in speed; the latter varies from 5 to 10 miles per hour, according to the gear ratio and wheel diameter of the particular vehicle to which the generator is fitted.

Referring to the regulator, movement of one of the contacts is caused by a cam on the generator shaft, so that the operation is positive, the contacts being either in intimate contact or entirely open; a slight wiping action is, however, provided in order to keep the contacts clean. The effect of opening and closing the regulator contacts is to cut in and out a resistance connected across the contacts and in series with the shunt field winding of the generator, the time the contacts are closed varying with the speed. It is claimed that the generator is able to maintain a proper voltage and current output, even if the battery becomes disconnected. It may be added that an opening in the end bracket affords access to the regulator adjusting screw.

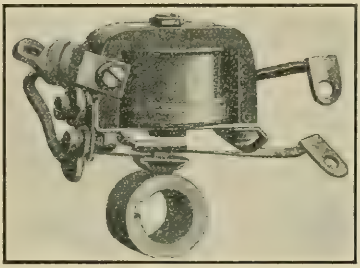

Fig. 2.—Regulator.

The action of the regulator may be followed from fig. 2. The contact connected with the armature moves backwards and forwards with the latter to and from the end of the armature core as the amount of flux through the core varies. Thus, if the voltage tends to increase, the top contact will be withdrawn from its mean position, while if the voltage tends to decrease, the upper contact will approach the lower one, and thus make the duration of contact longer in each revolution. Adjustment is made by bending the brass piece at the outer end of the steel frame of the machine and thereby moving the armature nearer to or further from the core, as may be desired.

The Bijur Electric Engine Starter with Automatic Engaging Gear.

A good deal of ingenuity continues to be shown in connection with electric motors employed on petrol motor vehicles for engine-starting purposes, especially as regards the method of bringing the driving pinion of the motor automatically into engagement with the toothed ring formed on or connected with the engine flywheel. The accompanying drawing shows in section what is known as the automatic direct shift adopted on a new series of engine starters, which has recently been introduced by the Bijur Co., of Hoboken, N.J., U.S.A. As will be seen, the mechanism consists of a pinion attached to a barrel-shaped casing mounted on the end of the motor armature shaft. When the starting switch is closed, causing the armature shaft to rotate freely, the inertia of the drive mechanism prevents it from revolving as a unit with the shaft, with the result that the whole mechanism travels longitudinally along the shaft, moving the pinion into mesh with the teeth on the flywheel. In case the pinion teeth do not mesh smoothly with the flywheel, but "butt" end to end, which it has been demonstrated happens approximately once per 300 starts, the mechanism does not jam or injure the teeth; the pinion merely compresses the large spring in the barrel, as it tends to move backwards, until the clutch mechanism exerts sufficient force to rotate the pinion so that it snaps into mesh with the flywheel. The direct shift is mounted directly

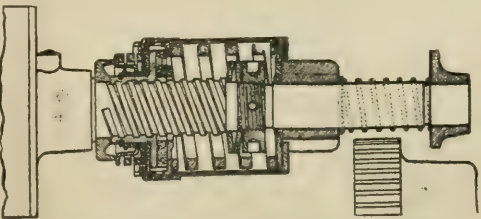

Fig. 3.—Section of the Bijur Automatic Direct Shift.

on the armature shaft of the motor, the screw threads being cut on the shaft instead of on a separate sleeve, thus enabling a shaft of larger diameter, and of considerably greater strength, to be used.

Electric Tramcar Cooking Equipment.

The electric cooking plant of the Halifax Corporation tramcar, which was recently fitted out as a travelling national kitchen, and to which we briefly referred in our last issue, under the heading of "Tramway and Railway Notes," was made by Messrs. Belling and Co., Montague Road, Upper Edmonton, London, N. 18.

The cooking plant consists of two baking or roasting ovens, each 32 in. high × 22 in. wide × 21 in. deep inside, and fitted with six racks spaced 5 in. apart, the actual size of each rack being 18¾ × 19½ in. The ovens are constructed of sheet metal on angle iron framing, and are adequately lagged. The loading is 6 kw., divided into four sections, controlled by four quick-break rotary switches fitted on the oven framing. There are 24 heating elements, 12 on each side, all interchangeable and easily fitted; ready inspection can be made of all the interior work by removing the racks and lifting off the runner frames. No asbestos covered wire is used in the wiring up, all connections being stiff heavy conductors, open for inspection and well guarded. For steaming, four steam cooking ovens are provided each 16 in. × 16 in. × 24 in., and fitted with four shelves. The loading of each is 3 kw., controlled by three indicating switches fitted on a separate sheet iron panel, and connected to the steamers by flexible metallic tubing. Each of these steamer cookers is fitted with a group of standard mica former elements, all interchangeable and independently connected. For soup making, vegetable boiling, or stew making, a 25-gallon boiling pan is provided; this is fitted with an outer casing for heat insulation, and is provided with a large draw-off tap. The loading is 9 kw., divided into four sections, and controlled by four quick-break rotary switches. The switches are fitted to a separate panel, connected to the boiler by flexible metallic tubing. As a further means of making soup, and carrying out small boiling operations six 12-in. hot plates are provided, each of these being fitted with a light tinned-plate boiling pan of about 4 gallons capacity. Each hot plate is loaded to 2 kw. on two sections controlled by two switches mounted on a separate panel, and connected by means of flexible metallic tubing to the hot plate. The whole of the apparatus is arranged to work on a 550-volt circuit with one pole earthed, and it is interesting to know that the whole of this plant was put to work without the least trouble, not a single fuse being blown during the conecting up, and testing, and subsequent cooking operations. All the plant is thoroughly well earthed, and it is difficult to see any possibility of anyone obtaining a shock. The wiring arrangements are as generally carried out on a tramcar system, the live pole being taken through a fuse on to the switch panel in each case, and the neutral or return pole being connected straight on to the other main terminal on the panel. The two ovens will cook 720 1-lb. portions of pie or similar per hour in two batches, each batch taking half an hour to cook (consumption about 12 units); or 600 fish cakes, each 3½ in. diameter or similar per hour in two batches (consumption about 12 units); or 360 portions milk pudding per hour in one batch (consumption about 8 units); or 108 lb. bread per hour in one batch (consumption about 12 units). The four steam cooking ovens will cook 1,152 dumplings (2½ in. diameter) per hour in two batches at a consumption of about 12 units; or 160 lb. potatoes (320 portions) at a consumption of about 12 units, and other vegetables such as carrots, parsnips in a similar manner and consumption. The working capacity of the boiling pans under the particular conditions obtaining on this installation is approximately 33 gallons (350 portions of ¾ pints each), soup, stews, &c., or the pans can of course be used for vegetable boiling if desired. A travelling kitchen of this nature has a very great practical utility; it can be run into the central food preparing depôt, the cookers filled with food, and the cooking commenced at once, and continued whilst the car is on its journey to a suitable distributing centre, such as, for instance, suburban "dead ends," loops, &c.

Electric Steel on the Rand.—A second electric furnace is now being erected at the Robinson Deep, where the existing plant is turning out 70 or 80 tons of shoes and dies per month, meeting, say, 10 per cent. of the requirements of the mines. When the second furnace is installed, it is hoped that there will be a regular output of 100 tons per month. An advantage of this extension will be that there will be no necessity to cease operations when a furnace has to be relined. Since it is impossible to import electrical material for a new furnace, odds and ends have to be collected from mining places, but as in the case of the existing plant, the difficulties are being overcome.—*Cape Times.*

Observing Blade Clearance in Turbines.—According to German Patent No. 288,626 granted to Fr. Krupp A.-G., a steam-tight inspection window is provided in the housing of the turbine. If desired, a number of such windows may be provided at different points round the housing, so as to permit inspection of the blade clearance over the whole length of the turbine without unduly weakening the housing. The sector of guide blades which spans the inspection window may be milled from the solid or built up from component parts, soldered or riveted together so as to be of sufficient strength. The window extends over at least one ring of moving and one of stationary blades.—*Elektrotechnik und Maschinenbau.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trade in Canada.

According to the statement of the British Commissioner in Canada, which appeared in the Electrical Review some time ago, in the majority of cases of American loans to Canada, it is a condition of the contract that the funds advanced shall be expended on goods produced in the United States.

In the years 1910-13, during which period I was in Canada, I observed with surprise that, as far as I could gather, there was no move on the part of any of the British financial interests to make any proviso that the money they advanced should be expended, as far as practicable, on goods made in the United Kingdom where these were available and met the market conditions; and, failing this on Canadian-made goods, using foreign-made goods as a last resort.

From the table you give for the years mentioned above, the percentage investment of new capital by the United Kingdom in Canada was 81·5, 76·56, 72·65, and 74·25.

During the war the U.S.A. have practically taken the United Kingdom's place in this respect.

In view of the enormous amount of money which the United Kingdom advanced to Canada, it will be realised what a tremendous amount of business was lost to us from neglect and want of foresight on the part of the British financiers.

I would like to say right here that it would be folly to invest money in a country and then make that country purchase something which it did not want and which did not meet its requirements; but there is very little doubt that a great deal of the money advanced by the United Kingdom could have been made still more profitable to this country by seeing that where we made suitable goods, and at a reasonable price, these should be purchased in preference to those from anywhere else.

When the country is again in a position to loan money, it is to be hoped that the financiers will use more foresight.

The above arguments hold good equally for British investments in any part of the globe.

G. F. Sills.

Manchester, *April 30th*, 1918.

Economy of Large Steam Turbines.

In your article on "Large Steam Turbines" in the issue of your paper dated April 26th, you refer to the steam consumption guarantees which were given in connection with the 25,000-kw. turbo-alternator supplied some years ago by Messrs. C. A. Parsons and Co., Ltd., for the Fisk Street Station of the Commonwealth Edison Co., U.S.A.

Although, as you state in your article, these guarantees indicate a very low steam consumption, it occurs to us that it may interest your readers to be referred to the article in your issue of December 19th, 1916, headed "Economy in Power Generation and Distribution." This article deals with an address delivered under the auspices of the American Society of Mechanical Engineers by Mr. Samuel Insull, where he gives a curve showing the *actual* steam consumptions obtained under test on the plant referred to above. To save your readers referring back to this article, I give in tabular form the points from which this curve is plotted compared with the guarantees above mentioned. These figures show the very high economy actually attained on this machine:—

Steam Consumption.—Parsons Turbo-Alternator.

Stop-valve pressure, 200 lb. Superheat, 200° F. Absolute pressure in condenser, 1 in. mercury.

Guarantee.		On Test.	
Load kw.	Lb. per kw.-hour.	Load kw.	Lb. per kw.-hour.
10,000	12·5	10,230	11·43
15,000	11·65	14,000	11·0
		18,400	10·68
20,000	11·25	20,060	10·46

It may be of interest to your readers to know that recent tests taken after the plant had been running almost continuously for nearly four years show that the steam consumption is still exactly the same as it was early in 1914.

A. H. Law.

Newcastle-on-Tyne, *May 6th*, 1918.

The 12½ Per Cent. Bonus.

With reference to the recent award of 12½ per cent. bonus granted to all workers engaged in the electrical industry, I shall be interested to have an official ruling as to the position of technical and central station clerks who are wholly engaged upon the preparation of statistics, technical records, stores books and other data, including all work connected with the men's wages.

As you may be aware, the position of the technical clerk is vastly different from that of the ordinary commercial clerk, inasmuch as in the former case his duties are of a specialised character, and demand not only special training in his particular class of work but also a good general knowledge of the fundamental principles o the running of electricity power stations.

In view of this, the technical and station clerk is, in his capacity surely as essential to the efficient running of a power house a other members of the works staff and if for instance, the 12½ per cent. bonus be granted to the storekeeper, who probably works under the direct supervision of the clerk, it is obviously grossly unfair to the clerk to be precluded from participating in the award.

I thought the question would be of some interest to your readers, as, doubtless, there are many in a similar position who have very hazy ideas as to the correct interpretation of the award in this connection, and I shall feel grateful if any of your readers could enlighten me on the subject.

Technical Clerk.

[This question has been raised on several occasions already. There is no definite ruling on the point as yet.—Eds. Elec. Rev.]

Tubular Earths for Lightning Conductors.

With reference to the above very interesting article in this week's issue, I would like to ask the author by what method of testing "the constant resistance of under 5 ohms was obtained," and what was the nature of the test applied to "the large number of tubular earths sunk by Messrs. W. T. Furse, of Nottingham, to obtain the value of 1 ohm"?

Mains Superintendent.

The Electrical Power Engineers' Association and the Association of British Electrical Engineers.

In your footnote to this correspondence published in your issue of May 3rd you state that the question whether the Association of British Electrical Engineers shall or shall not be registered as a Trade Union is of the first importance. I respectfully beg to differ, and to submit that the point of first importance is whether, considering that the Electrical Power Engineers' Association is an accomplished fact, that it has done the pioneer work of organisation, that it is taking a strong line in the direction of improved efficiency, pay, and status for electricity supply engineers, and that it is the staff engineers' own Association, brought into existence by their own unaided efforts, there is the least justification for proposing, so late in the day, to form a new body with the same objects in view and recruiting from the same class of engineers.

I certainly consider that, as unity is our most urgent need, any proposal to set up a new protective body is disastrous, and any support given to it by staff engineers is unwise and unfair to both themselves and their colleagues.

E. B. Pausey.

Bury, Lancs., *May 3rd*, 1918.

LEGAL.

Osram-Robertson Lamp Works, Ltd., v. Goossens, Pope and Co., Ltd.

In the Chancery Division, on May 3rd, counsel made application to Mr. Justice Astbury for judgment in default of defence in this action.

His Lordship, after the usual inquiry as to the proceedings being in order, entered judgment for the plaintiffs in the terms of the motion.

Calmont King & Co., Ltd., v. Brain.

In the City of London Court, on May 2nd, before his Honour Judge Atherley-Jones, K.C., plaintiffs, of Milton Street, E.C., sued Mr. C. Brain, trading as the Bleriot Cycle Co., Bristol, for £5 2s. 2d. for refills for electric lamps supplied. The question in dispute was whether or not the refills were of the quality ordered. They were sold by description.

Mr. Harry Strouts, for defendant, said they were guaranteed for three months from the date they left plaintiffs' premises.

Plaintiffs' Solicitor said that the goods were delivered in February and March. In May defendant returned the refills sued for, and complained that they were not of the quality ordered. They were of 4 volts—the proper strength. When they came back they still registered 4 volts, the guaranteed standard. Defendant returned the batteries in May, when there was plenty of daylight and not many lamps were required. It was the off season, and the defendant, being overstocked, tried to get rid of those on hand.

Edward Dumphy, plaintiffs' representative, said that he tested all the batteries before they were sent out. Defendant kept them over three months. During that time refills might easily deteriorate, depending on the conditions under which they were kept. Refills left over from one season to another would be absolutely useless.

In cross-examination, he said they often had batteries returned through being defective, and so did other firms. Very few were sent out defective. Sometimes they stopped on the railway too long, and then became overheated, and dampness would cause them to sweat, which set up a leakage.

Mr. A. G. Mardin, director of the plaintiff company, said that the returns due to defects were usually not more than 3 per cent. or 4 per cent. Defendant's returns were unreasonable.

Defendant denied that he sent the batteries back because it was the end of the season. They were not up to the guarantee two weeks after arrival, and he returned them. Some firms' batteries were good after being nine months in stock. Plaintiffs' batteries were 2½ volts only. He warmed them up, and they revived for half an hour, but they soon went down again. He had returned thousands of batteries to one firm or another without objection.

Judge Atherley-Jones, K.C., found for the plaintiffs, with costs, but said he did not feel very certain about his decision. Defendant dealt with the matter in a foolish way.

Hemming v. London Electric Railway Co.

Mr. Justice Bailhache, sitting with a special jury in the King's Bench Division, on May 3rd, heard an action in which Mr. Henry Q. R. Hemming, a solicitor, sought to recover from defendants damages for personal injury arising out of an accident to their lift at the Russell Square Tube Station.

The case submitted by the plaintiff was that while he was in the lift with about 50 other passengers, it jammed. There was much alarm amongst the occupants, and considerable shouting by the young woman in charge. Suddenly one of the walls fell back, and it proved to be a secret door, behind which the plaintiff found himself. In the meantime another lift had been brought alongside; and the people thronged through the emergency door into the second lift. When the plaintiff, according to his account, attempted to step across the space between the two lifts, he fell with his leg between them, causing the injury complained of. He said that he subsequently discovered that the space into which his leg went was wide enough to have allowed him to fall to the bottom of the shaft. He suffered injury to the knee which incapacitated him for some time, with the result that during that period he lost £15 a week, partly in fees for massage manipulative treatment, to which he had devoted himself for some years past, and partly from a book on physiology on which he was engaged. He admitted, in cross-examination, that the injunction to "mind the step" was in his mind and that he had seen the people stepping up from the one lift to the other.

Mr. Justice Bailhache held that there was no evidence of negligence on the part of the company or their servants, and directed a non-suit against the plaintiff.

Factory Acts Prosecution.

At the Sheffield Police Court, last week, at the instance of Mr. J. Law, H.M. Inspector of Factories, Messrs. Thomas Firth & Sons, Tinsley, were summoned for breaches of the Factory Acts. According to the *Sheffield Telegraph*, Mr. Law stated that a cable under the high pressure of 11,000 volts in the transformer house was covered with about four thicknesses of "Empire" wax-covered tape, which was not sufficient insulation for a conductor of such high pressure. There was no metal screen round the cable, such as now had been suggested by the Factory Inspectors. A sweeper named Jenkinson was killed.

For the defence, Mr. Neal said the firm had done everything necessary to prevent accidents. At the request of the Ministry of Munitions they had put up certain works, but they were not yet finished, and it had not been possible completely to insulate this cable, and even a metal fence round it would not entirely safeguard those working near it. Jenkinson had no necessity to come in contact with the conductor in the course of his regular duties, as the transformer house was thoroughly cleaned each Sunday, when all current was cut off. He must, therefore, have been taken ill, and caught his brush against one of these live transformers, which was in a pit. It was not necessary, he contended, for the man to act constantly under the eye of the foreman. He was "a competent person acting under the immediate supervision of an authorised person."

The Chairman pointed out that Jenkinson was left three hours without supervision, which was a very risky proceeding.

A fine of £20 was imposed.

Assault on a Non-Union Man.

A case in which the prosecution relied upon the Trades Disputes Act of 1906, was heard at Great Marlborough Street Police Court on Tuesday, before Mr. Denman, it having been adjourned from a date in April, when one man was charged with an assault, but now there were two defendants, the further one being summoned. All the trouble had apparently arisen through the employment of a Non-Union man, in what was described as "a Union shop." The prosecutor, Mr. Albert Edward Muller, an electrical fitter, was employed by the New System Private Telephone Co., Ltd. He charged A. E. Owen that he did at Great Portland Street and Euston Road unlawfully use violence, and intimidate A. E. Muller, with a view to compelling him to abstain from pursuing his employment. There was also a summons against G. D. Turner that he did unlawfully watch or beset the premises where A. E. Muller was employed, and the approach to the said premises, and intimidate him and follow him with two or more persons, in a disorderly manner, and hustle him and threaten him with violence, with a view to compelling him to abstain from his lawful employment.

Mr. Ganz (barrister) appeared for the prosecution, and Mr. Zeffertt was counsel for both defendants.

When the case was called on Mr. Zeffertt said he had carefully gone into the evidence, and thought it was a proper case to go for trial. The charge against Owen was one of violence, but that against Turner was not so grave. They were under the Conspiracy and Protection to Persons Act of 1875 and the Trades Disputes Act of 1906. The magistrate would, of course, bear in mind that he might not find it necessary to send it for trial.

Mr. Ganz then said that the two defendants and Muller were in the employ of the New System Private Telephone Co. The prosecutor was a Non-Unionist, and the defendants were members of the Electrical Trades Union.

Mr. Denman said the case had already been opened, and it would save time if he read over briefly the depositions of Muller at the previous hearing. He said that at 8 o'clock on April 29th defendant approached him, and said: "Are you Muller?" to which he replied, "Yes." He was then asked if he was a member of the Electrical Employés' Union, and on saying "No," was told that he would be given one week to join. His answer was, "Let's get the war over first." He went to Tottenham to get a job, and on his return at 12.30 there were a number of men at the entrance, who abused him, and threatened him if he did not join the Union. He went in and got his bag of tools, and then went up Great Portland Street, when he was stopped by Turner, who afterwards followed and abused and pushed him. Turner followed him into Euston Road, and then, at a sign, Owen came across the road and knocked him down. While on the ground he was hit again. He got up and walked to the corner, and those that had followed him went away. Prosecutor went back to the shop and complained.

Muller was now recalled and examined by Mr. Ganz. He said he had been employed by the firm before, but again went into their employ in April as an electrical fitter. He was not a member of the Electrical Trades Union. When he went into their employ he was not asked about the Union, and did not know that the largest number of their employés were members.

Mr. Zeffertt: You can take it from me that it is so, although it does not matter.

Mr. Ganz: It is important, because, unfortunately, the Act does not say it is wrong to use violence, but it is wrong to use violence to cause anyone to abstain from doing his lawful work.

Muller went on to say that after doing a job at Tottenham he returned at 12.30 p.m., and as he went in at the door he was approached by a number of men. Owen told him he could not go into the premises because he was not a member of the Trade Union. He went in and fetched his tools and walked towards Great Portland Street, where he was struck in the left and right eyes by Owen.

Continuing his evidence, Muller denied that he went there with the idea of breaking it up as a non-Union shop. When he was engaged, Mr. Murray, the chief engineer, asked if he was a Trade Unionist, and he said, "No; but I suppose I shall have to join it now." Murray said it did not matter, so far as he knew.

Prosecutor agreed that there were a number of silver-badge discharged soldiers, which he did not know prior to the assault, but Mr. Murray never said he wanted to get rid of them. On the Friday there was a committee meeting of the Union, which gave him a week to join. There was a conversation between him and a man named Power, who turned out to be a wounded soldier who told him that it was only such as him that were keeping wounded soldiers out of jobs, and this he denied. He declared it to be untrue that he ever suggested that they were fools to join up and get wounded, and that he had taken particularly good care to get protection.

In the course of the hearing, when the depositions were read over to Muller, Mr. Ganz objected to the suggestion that he had German antecedents, for, as a fact, he was not German born, nor was his father.

Medical evidence as to injuries was then given.

James Jones was next called, and was wearing a silver badge. He said he was, in the same employ, and was there from March, 1917, as an outside hand, and now as a storekeeper. He had been a soldier, wounded, and was discharged from the Army. He was not a member of the Electrical Trades Union. He was outside the premises on the day in question, and saw Morgan, Turner and Collis; he did not see Owen. Muller came out, and Turner got in front of him, not exactly pushing him, but obstructing him. The other men also followed him, but he did not see anything further happen. There were others also who wore silver badges, which everyone could see. He had been asked on numberless occasions to join the Trade Union, but had not done so. He had never been assaulted in consequence, but had been "told off" very often. He had continued to stand out, however, and meant to do so, but had only one leg, and so had Collis.

Mr. Ganz: Who had asked you to join the Trade Union?

Witness: Nearly all of them from time to time.

Mr. R. L. Murray, chief engineer in the employ of the firm, said he was not a member of the Electrical Trades Union. So far as he knew, there were two who were not members, and all the rest were. At 8.30 on the morning of April 29th, Owen came to his office and put a paper there to the effect that a shop meeting of the Union had passed a resolution that if Muller was engaged he would be given one week to join the Union, failing which they would down tools. They also asked for other guarantees as to work, &c.

Mr. Denman: But the proper officials of the Union would naturally object to violence, so what have they to do with the acts of somebody who takes the law into his own hands?

Mr. Ganz: I am going to show that Owen is the shop steward, and I have to prove that there is something in the way of causing to abstain from work; it is not sufficient under the Act to prove the assault.

Witness went on to say that he asked for a day to consider the matter, and Owen said he thought that was fair, and he would put it to the men. He went outside, was gone half a minute, and came back and said the men would not stand it, and were going to down tools.

In cross-examination, Witness said he did not know that it was a Union shop, because he had engaged men who were not in the Union, who afterwards did join. It was true he asked Turner when he engaged him if he was a member of the Union, but that was only because under the Defence of the Realm Act he was entitled to see all papers. He did not use persuasion one way or the other. He had no intention of trying to turn this shop into a Non-Union shop.

Mr. Zeffertt put a piece of paper to the witness, and Mr. Denman asked what it had to do with it, and counsel replied that he wished to show how much this man could be believed when he said one thing in the box and wrote another.

Mr. Denman: I should keep to the point: but let us hear what the paper said.

Mr. Zeffertt then started to read the paper, which he said was in the form of an agreement.

Mr. Ganz: Unsigned.

Mr. Zeffertt went on to read that this was intended for anybody that was to be engaged, in which the firm bound the person not to join a Trade Union while in their employ, and offered to refund any money such men might have paid into a Union in War Certificates.

Mr. Denman: It shows nothing more than that Mr. Murray was inconsistent.

Mr. Zeffertt: If I do not further cross-examine I must ask Mr. Ganz not to take the point that I have failed to raise any point on the agreement.

Mr. Ganz: I do want the witness to say if the firm accepted the terms of the agreement.

Mr. Denman: What does it matter?

Mr. Ganz: At the trial the Judge will ask why the questions were not asked.

Mr. Denman: Then tell the Judge it was because the Magistrate said it was better to keep to the point in the prosecution.

Mr. Zeffertt: And the Judge will say what a wise Magistrate, and we shall all agree.

Mr. Ganz pressed for an answer to the question, and the Witness said the agreement was never entered into or acted upon by the firm.

Mr. Ernest Low, general manager to the firm, said that on the day in question he saw that the men were not working. Later on he heard of the assault, and saw the prosecutor.

The Magistrate said that he had heard enough to commit both defendants for trial.

Mr. Ganz: I ask particularly that the committal shall be under the Act, and not for assault only.

Mr. Denman said he thought it would be sufficient if they were committed for trial, Owen for assault and Turner for intimidation and following in a disorderly manner, under Sec. 7 of the Act.

The Magistrate declined to hear the evidence for the defence, which, it was suggested, would throw a great deal of light on the causes of the squabble, saying that he took a strong view as to the materiality of such evidence. The charge was one of assault, and it was useless to go into side issues on such a plain, straightforward case.

The defendants were then committed for trial to the Sessions bail being fixed at £40 each.

The Post Office Tube Railway.

Arbitrator's Award.

Mr. J. H. Oakley, as Arbitrator, has announced his award in the claim by the Great Eastern Railway Co. for £33,393 compensation from the Postmaster-General by reason of the taking of so much of the sub-soil as is required for the Post Office Tube Railway at Liverpool Street Station, and for injurious affection to adjoining lands by the carrying out of such works.

The Arbitrator says:—"I award and determine that the sum of £6,884 be paid by the Postmaster-General to the company for the acquisition of such easement or right of user of the sub-soil of the lands of the Great Eastern Railway, and that a further sum of £2,680 be paid by the Postmaster-General for or in respect of damage to be sustained by the company by reason of the severance of the said lands of the company or otherwise injuriously affecting the said lands by the exercise by the Postmaster-General of the powers conferred on him by the Post Office (London Railway) Act, 1913, or the statutory provisions incorporated therewith."

Reconstruction.—Yesterday evening there was held at Southwark Town Hall, under the joint auspices of the National Alliance of Employers and Employed and the Industrial Reconstruction Council, a mass meeting to promote "Self-Government for Industry." The speakers included the Right Hon. F. Huth Jackson and Mr. Ernest Benn, chairmen of the two organisations.

We welcome this joint effort of the two bodies, for everything is to be gained by concentrating our efforts in place of duplicating or overlapping. We are pleased to note from the report of the Industrial Reconstruction Council, which, since the meeting held at the Guildhall, has held public gatherings at Manchester, Nottingham, Edinburgh and Birmingham, that the Council has, through its president and chairman, been in touch with the Federation of British Industries, the National Alliance, the London Chamber of Commerce, the Engineering Employers' Federation, and the Industrial League. There is evidently a desire to establish suitable relations between all the bodies which are interested in industrial reconstruction, and we hope that some means of united effort will be found practicable. We agree that there is a vast amount of educational work to be done in order that employers and employed may alike fully understand what is meant by the self-government of industry, and what are the benefits likely to accrue from such a policy after the war.

WAR ITEMS.

Trading with the Enemy.—The "London Gazette" for May 3rd contains a further list of bodies and persons in the following countries with whom trading is prohibited:—Bolivia, Brazil, Costa Rica, Greece, Guatemala, Mexico, Morocco, Netherlands, Netherland East Indies, Norway, Panama, Portuguese West Africa, and Spain.

Ministry of Munitions Boiler Order.—The Ministry of Munitions orders every person to furnish to the Controller, Department of Engineering, such returns as to boilers belonging to him, or in his possession, or under his control, as may be required by the said Controller. The Order is described as "The Boilers (Returns) Order, 1918."

Restricted Occupations Order Revoked.—The National Service Order of February 28th, 1917, placing certain scheduled industries and occupations under restrictions has been revoked.

Electric Lamp Glass Control: Revised Order.—The Ministry of Munitions has issued an Order amending the Glass Control (Consolidated) Order, 1917. It has been found necessary to extend the provisions relating to electric lamp glass contained in the order, to vitrite and other glass used or intended for use in electric lamp caps for insulating purposes which were by that Order expressly excepted from the operation of such provisions. It is now ordered that as from May 7th the Order shall read and take effect as if in Clause 8 the words "and the expression 'electric lamp glass' shall include all glass used or intended for use in the manufacture of electric lamps, not excepting vitrite or other glass used or intended for use in electric lamp caps for insulating purposes, but shall not include glass shades and similar accessories" were substituted for the words "and the expression 'electric lamp glass' shall include all glass used or intended for use in the manufacture of electric lamps, except glass used or intended for use in lamp caps for insulating purposes, but shall not include glass shades and similar accessories." All applications in reference to the Order should be made to the Controller of Glassware Supply, Ministry of Munitions of War, 22/23, Hertford Street, London, W. 1.

Hull Corporation Electricity Staff.—An interview recently took place between a deputation of the Hull Corporation Electricity Committee and the Ministry of Munitions in regard to the calling-up of two skilled employés, and as a consequence the calling-up notices have been suspended. The opinion expressed by the Committee at their last meeting was that the calling-up of further skilled employés would jeopardise the efficiency of the undertaking. It was decided that the 12½ per cent. bonus granted in accordance with Sir George Askwith's award should apply to 11 technical assistants, and date from October 13th last, the same as in the case of other workers affected by the award.

Electric Supply and Red Cross.—By supplying electrical energy free of cost to the local Red Cross Hospitals, the Swansea Electricity Committee in effect are contributing £400 a year to these institutions.

War Effects on Australian Electrical Trade.—The *Sydney Daily Telegraph* states that the effect of the war upon the electrical industry is referred to in the annual report of the Electrical Employers' Association of the State. This effect, which is injurious, has been increasingly felt during the last 12 months, as power-houses, mines, and other industries have been unable to obtain supplies of machinery needed for extensions. A bright feature of the situation, the report proceeds, lies in the stimulus given to local manufacture of accessories, such as starters, switchgear, and so on. These were imported previous to the war.

Sale and Purchase of Machine Tools.—It is announced officially that power-driven machine tools or wood-working machines and treadle lathes for wood-working or metal (3-in. centres and over) come under the Defence of the Realm Regulations (Regulation 30 A). Intending purchasers must make application for permission to purchase the machines they require to the Executive Officer of the Area Clearing House Board in their district. Firms (including auctioneers) must obtain permission to sell machines from the Controller of Machine Tools, Charing Cross Buildings, Embankment, W.C. 2.

Exemption Applications.—In applying for a coachmaker, the only man of that trade in the department, Mr. Pilling, manager of the Accrington Corporation tramways, told the Tribunal that this man's work had increased greatly owing to the inexperience of motormen, there being more collisions. Temporary exemption to September 12th was given.

At Brierley Hill, Mr. J. Holmes defended a National Service Appeal against exemption held by an electrical engineer (29, C 1), the only man left for this class of work, and engaged on motors and electrical appliances at works in the district. Mr. Holmes said that his own son was in the Army, and his partner had died. The appeal was refused, and the exemption confirmed.

The Warsop Tribunal has refused to grant exemption to J. Sockett (22), electrical engineer.

At the Berks. Appeal Court, the National Service Representative appealed against conditional exemption granted to P. G. Lovegrove (35, B 1), electrical fitter with Mr. J. Bond, boatbuilder, on the ground that the man was engaged in a non-essential occupation. Mr. Bond denied that this was so, and said that a good deal of what the man did was war work. The appeal was respited with the object of a protection certificate being applied for.

At Lancaster, a firm of electrical engineers appealed for an electrician (40, Grade 3). He was given until July 31st. The Corporation appealed for a tramway inspector and occasional driver (41, Grade 2), who was stated to be necessary for supervision with the present inexperienced staff. The appeal was dismissed as from the end of May.

Essex Appeal Court has granted conditional exemption, whilst engaged in the tramway department of the Leyton U.D.C., to B. Hayes (41, Grade 3).

At Carlisle, the National Service Representative appealed against exemption granted to H. Ellison (Class A), electrical engineer and fitter with Messrs. R. M. Hill & Sons. It was asserted that the man spent about half his time on domestic work, and was of the class of men required at the present time. For the firm, it was contended that the man's work was mainly in connection with repair work for motors in the big works at Carlisle, and at times he had to assist the Corporation electrical department. The appeal was dismissed.

Torquay Tribunal has decided that E. J. Rawlings (Grade 2), traffic inspector on the tramways, shall be called up by May 15th, and has adjourned for grading an appeal by W. Drury, electrical engineer.

On the appeal of the Tramway Co., the Kidderminster Tribunal has granted exemption until September 30th to E. Turner (37, Class A), car-shed man, and J. Whitmore (31, Grade 2), driver.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until August 31st to B. R. Eves (37), conductor and motorman on the Corporation tramways.

At Northampton, on Tuesday, an appeal was made for the renewal of the certificate of P. Penn (35, Grade 1), a foreman carter engaged in carting coal for the Northampton Electric Light & Power Co. It was stated that the man was responsible for the removal of 68 tons of coal from the railway station daily, and for seeing that the trucks were kept clear in order that they might be utilised again at the earliest possible moment. Two months final was given, and when a request was made that the finality should be subject to substitution, the Chairman said substitutes for positions of this kind could not be found.

BUSINESS NOTES.

Paper Shortage.—Owing to the great and growing shortage of paper, the public are requested to exercise the greatest economy, particularly in the matter of stationery. Much of the notepaper now in use is extravagant in size and quality. There is also room for the practice of paper economy in packing departments and stores and in many manufacturing activities.

Commercial Apprenticeships.—The L.C.C. has agreed to co-operate with the General Electric Co., Ltd., in a scheme whereby the company will select about 12 apprentices yearly from boys between 15½ and 17 years of age who are specially recommended by the principals of evening institutes, or by headmasters of secondary or central schools, or have passed the London matriculation or an equivalent examination. The company bind themselves to allow the apprentices facilities for attendance at evening classes on three nights a week over a period of three years, and have submitted for the Council's approval a draft indenture of apprenticeship. The L.C.C. is satisfied that the company's scheme and the indenture of apprenticeship are such as can be approved, and that the prospects offered by the company's service are such as to justify the Council in assisting the company to obtain apprentices.

The Sterling Athletic and Social Club.—The Lady Footballers of this club (Sterling Telephone and Electric Co., Ltd., Dagenham) on Saturday last brought their season to a close at the Gordon Club Ground, Ilford, when they met the London General Omnibus Co.'s Forest Gate Ladies' Team. The match was organised for the benefit of the funds of the Ilford Emergency Hospital. Mrs. Guy Burney, wife of the president of the Sterling Club, kicked off, and with Lady Griggs presented the medals at the close of the match, which resulted in a victory for the Sterling Team by 11 goals to nil, thus enabling them to wind up a remarkable season with an undefeated certificate, with a record of 20 games played, 18 won, 2 drawn, and a goal average of 103 against 10. The ball used in the match was sold by auction on behalf of the hospital funds, and was knocked down to Mr. Guy Burney for 35 guineas.

Trade Announcements.—Mr. E. C. Beman, having entirely severed his connection with the Electrical Supplies Co., of 233, Tottenham Court Road, W., Mr. Percy L. Davies, of Messrs. Downes & Davies, Liverpool and Manchester, has been appointed director in control of the company.

The Export Department of Messrs. Pass & Seymour (Inc.), of Solvay, N.Y., has been moved to 6, Church Street, New York City.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Descriptive list, No. 2,142—B (40 pages) containing full information respecting their two and three-phase induction motors. There is a large amount of tabular matter and numerous half-tone illustrations of complete machines and parts thereof are given.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4.—Folder giving "Hints to Electric Light Consumers," explaining the Government Lighting Restrictions Order. The notes tell how economies may be effected and how to read the meter. Quantities of the folder can be supplied to contractors, printed with their name and address, on application.

Munitions Dispute Settled.—It was officially announced on Saturday that a satisfactory settlement of the dispute at the Chilwell National Filling Factory had been reached at the Ministry of Munitions. A notice signed by Mr. W. J. Webb, London district secretary of the Electrical Trades Union, and Mr. H. P. Bolton and Mr. J. Potter, members of the Union, instructs all men concerned to resume work at once.—*The Times*.

Dissolutions and Liquidations.—Linolite Co., 25, Victoria Street, London, S.W.—Messrs. A. S. E. Ackermann and R. L. Matthews have dissolved partnership.

Electricity Supply Co. for Spain, Ltd.—This company is winding-up voluntarily. Liquidator: D. Merry del Val, 45, Grosvenor Place, London.

Electrolytic Alkali Co., Ltd. — Meeting of creditors, May 21st, at 24, North John Street, Liverpool. Liquidator, H. G. Alexander.

Grondal Kjellin Co., Ltd.—Meeting, June 7th, at 20, Abchurch Lane, E.C., to hear an account of the winding-up. Liquidator, Mr. G. H. Hill.

Firth & Russell, electrical engineers, Kirkstall Road, Leeds.—Messrs. E. G. H. Firth, A. S. Russell, and H. F. Moore have dissolved partnership. Messrs. Russell and Moore will continue the business as Firth & Russell.

Patent Surrender.—The Comptroller-General gives notice that J. O. Callender and Callender's Cable and Construction Co., Ltd., have offered to surrender, under Section 26 (3) of the Act of 1907, Patent No. 104,793, for "Improvements in Multicore Electric Cables."

Book Notices.—*A Dictionary of Aircraft.* By W. E. Dommett, A.F.Ae.S., M.I.Mar.E., A.M.A.E. London: Electrical Press, Ltd. Price 2s. net.—The scope of this dictionary has been arranged to include all aeronautical terms, scientific, technical, and popular, and also symbols and abbreviations used in the leading aeronautical periodicals and text-books. It will form a handy reference book to those already possessing some technical knowledge of aeronautics, and will be found of much use to the wide circle of general readers interested in the problem of flight.

Short Logarithmic and Other Tables. By W. Cawthorne Unwin, F.R.S., LL.D. London: E. & F. N. Spon, Ltd. Price 1s. 6d.—This, the sixth, edition, contains tables which are intended to facilitate arithmetical calculations in those cases in which great accuracy is unnecessary. The accuracy and rapidity of calculations are increased if the logarithms of the constants and multipliers which most frequently recur are known, and tables of such constants are, therefore, appended. Tables of the weights of different materials and of iron of different forms are added to facilitate estimating, and these are arranged both for English and metric measures and weights. Care has been taken that all tables should be as accurate as their scope admits, and they have been made as brief and compact as possible.

Industrial Engineering: Present Position and Post-War Outlook. By F. W. Lanchester, M.Inst.C.E. London: Constable & Co., Ltd. Price 1s. net.—This consists of a reprint of the author's presidential address delivered before the Institution of Civil Engineers in December, 1916, and republished by permission of the Junior Institution of Engineers. It should afford great interest and food for thought to a wide circle of readers.

What Industry Owes to Chemical Science. By Richard B. Pilcher and Frank Butler-Jones, B.A., A.I.C., with an introduction by Sir George Beilby, LL.D., F.R.S. 1918. London: Constable & Co., Ltd. Price 3s. net.—These records supply a complete answer to the question: What is the place of the chemist in practical life, and what part has he taken in industrial and social development? The engineer ministers to the comfort and convenience of the community in ways which can hardly escape the notice even of the man in the street. The work of the chemist, on the other hand, is inobvious, and is little, if at all, understood.

The contents of this volume appeared as a series of articles published in *The Engineer* during 1916 and 1917, under the title of "What Industry Owes to Science." The articles were not intended to embrace subjects of common knowledge to the engineer, but dealt mainly with chemical science. For that reason the title of the work has been modified; the text, however, remains practically the same. A bibliography is provided, including many useful books referred to during the preparation of the work. The object of the authors has been to take each industry in turn, and to show by examples how science has advanced the methods and processes of production, and had laid the foundation for the establishment of new manufactures. The work covers a survey of many important industries, and is not out of the depth nor beyond the interest of the educated public. It should be especially useful to students of chemistry and engineering, and will supply teachers of chemistry with abundant material for the purpose of the study of the achievements of science in industry.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 4. April, 1918. New York: The Institute.

LIGHTING AND POWER NOTES.

Argentina.—A decree has been issued authorising Messrs. Etchemaite, of Llanos, and Carlos Menendez Behety to install and work electric power installations for lighting, power, and heating in Puerto Deseado, Territory of Santa Cruz, and to utilise public lands situated within the municipal boundaries for the transmission lines. A power station of 200 KW. capacity is to be installed as a commencement.

The maximum prices per KW.-hour which may be charged are:—For the lighting of business premises or private dwelling houses, $0·40 m/n.; schools, hospitals, and public offices, $0·35 m/n.; public lighting subjected to a rebate of 30 per cent.; and electricity for heating, motive power, and other industrial uses, to a rebate of 50 per cent.—*Review of the River Plate.*

The Buenos Aires correspondent of the *Times* stated, under date April 23rd, that "The German Electric Light Co., wearying of the struggle to maintain fuel supplies, is discussing with the municipality terms of handing over the concern and rescinding the concession."

Belfast.—Proposed Extension.—At the last meeting of the Corporation, Councillor J. C. White, in moving the minutes of the Electricity Committee, stated that the expenditure for which sanction was applied for to the L.G.B. was about £311.000; an inquiry had been held, which was believed to have been satisfactory. This expenditure would cover the first section of a new and up-to-date generating station at the harbour, which would contain two 6,000-KW. turbo-alternators, with space for a third set of 12,000-KW. capacity, and ample space for future development. The necessity for the Committee's decision was confirmed by the urgent requirements of the shipyards of Messrs. Harland & Wolff and of Messrs. Workman, Clark & Co. To meet the imperative demands, and as the new station could not be completed until the autumn of 1919, one of the 6,000-KW. sets already purchased by the Corporation would be temporarily fixed at East Bridge Street. Particulars of the arrangements which had been entered into with the two firms for a provisional supply of electricity were submitted, and it was stated that on the terms arranged by the Sub-Committee the revenue from these sources would be about £70,000 per annum up to the end of the first year of peace. Negotiations were still in progress with the shipyards as to the terms of supply for a subsequent period of 10 years following the present proposed contracts. A great advantage of the new scheme was that the coal consumption at the new station per unit generated was estimated at 3 lb., instead of 4½ lb. as at present, a saving on an output of 30,000,000 units of 20,000 tons of coal a year. The Committee was awaiting the formal sanction of the L.G.B., and had applied to the Ministry of Munitions for a building licence and a priority certificate for the steel work and plant. Both the Government and the local shipyards had supported the application. The minutes were adopted by the Council.

Blackpool.—Fuel Charges.—Mr. Charles Furness, the Corporation electrical engineer, has prepared a return of fuel charges during the 17 years of his management. In 1902 15,289 tons of coal were consumed at a cost of £7,867, with an output of 2,262,516 units. Two years later the 14,869 tons cost £7,302, and 2,570,180 units. Last year the coal consumption was 14,324 tons, costing £13,759—nearly double the price of 1904—and the output was 6,375,398 units. The net profit for the past year is £8,083, or £6,000 more than was estimated; but the surplus for the next 12 months is estimated at £4,000 only. The engineer has received the Committee's instructions to connect the Bispham cables with those of Blackpool, and to dispose of plant which is not wanted at Bispham when the works are closed down. The Bispham installation, which cost about £17,000, was the work of the local District Council prior to amalgamation.

Year's Working.—The income of the Corporation electricity undertaking for the past year was £57,941, as compared with £47.035 the previous year. The working expenses were £31,432, and the disposable balance is £8,083, compared with £357 last year.

Bolton.—New Showrooms.—The Electricity Committee has accepted the recommendation of the Special Sub-Committee to secure premises in Knowsley Street for the purpose of the electrical fittings department for 10 years, consisting of three shops, workshop, and stores. The electrical fittings department is to be removed from the gas offices.

India.—Correction.—We are informed that the two 5,000-KW. generators at the new generating station at Loyabad are, like the turbines, of British Westinghouse manufacture, not as stated in the Electrical Review for April 26th.

Leeds.—Proposed Extensions.—The Electricity Committee has recommended the purchase from Messrs. Henry Briggs, Son & Co., Ltd., colliery owners, of a coal wharf and premises adjoining the Corporation electricity works and the river Aire, for the purpose of extensions. The price is £5,500.

Lymington.—Price Revision.—The R.D.C. has been informed that the E.L. Co. is applying to the B. of T. for sanction to increase the price of energy from 7d. to 9d. per unit, with an agreement not to charge more than 8d. The proposal is objected so by some members, but the chairman expressed the opinion that the offer of the company was a fair compromise, as if they did not agree to 8d. they might have to pay 9d. The question of assenting or objecting has been deferred.

London.—L.C.C.—Loan Sanction.—The Finance Committee recommends the sanction of the Council to the borrowing of £4,000 by the St. Pancras B.C. for a 1,000-kw. motor-converter, &c., and of £6,734 for electricity purposes, mainly for the excess cost owing to war conditions of contracts previously entered into; and of £3,838 by the Woolwich B.C. for linking-up purposes.

Hammersmith.—Plant Extension.—The Electricity Committee has had under consideration the question of the provision of additional boiler-house plant. Tenders have been obtained for the supply of a water-tube boiler having about 8,000 sq. ft. of heating surface for erection alongside the existing boilers, and it has been found that the total cost would amount to approximately £12,000. It is improbable that the work of installing the boiler would be carried out in time for its use during the coming winter. The Committee has, therefore, considered the alternative of installing a larger boiler in the present boiler house with a grate area of 240 sq. ft., and a heating surface of 9,500 sq. ft., which would be capable of driving the largest turbine. This involves the dismantling of three old boilers on which there is an outstanding debt of £2,716, but the Committee anticipates being able to dispose of these boilers at approximately the same figure (the estimated cost of installing the larger boiler), and the Committee recommends that tenders be obtained for the larger boiler, for delivery during the coming winter.

Lynton.—Rationing.—The B. of T. has exempted customers of the E.L. Co. from rationing of electricity on condition that no fuel is used at the works, which are run by water power only.

Newcastle-under-Lyme.—Linking-up.—The Electricity Committee has instructed the electrical engineer to prepare specification of the work required for the purpose of linking-up the Newcastle undertaking with that of Stoke-on-Trent, and to obtain tenders.

Rathmines (Co. Dublin).—Sale of Undertaking.—Notice has been given by Mr. Carruthers at the Urban Council to move the appointment of a Committee to consider the financial position of the electric lighting undertaking and the advisability of disposing of it.

Rochdale.—There was sharp criticism at the meeting of the Town Council on the recommendation of the Electricity Committee to apply the depreciation fund to the liquidation of the accumulated deficit. Councillor Wycherley said the suggestion was dangerous and unsound, and Councillor Shawcross said it was "the most rotten finance possible." Councillor Wycherley said that nothing depreciated more quickly than electricity works plant, and Councillor Lord declared that on a capital outlay of nearly a quarter of a million, a sinking fund of £54,000 and a depreciation fund of less than £10,000, were inadequate. Alderman Clark said that a portion of the machinery had been sold for four times the amount at which it stood in the books. It would be impossible to raid the depreciation fund next year, because there would be nothing in it. Councillor Walker, the chairman of the Committee, said they adopted their policy after taking the best advice. The so-called depreciation fund was created because the Committee had no experience of the life of electricity plant, and they found it did not depreciate so quickly as had been anticipated. The Committee's recommendation was approved.

The T.C. has increased the charges for electricity, as from May 15th, to 50 per cent. on pre-war rates to lighting consumers, without discount, and the rates for power have been again advanced.

Rotherham.—Year's Working.—There is a surplus of £465 on the year's working of the electricity undertaking, after allocating £423 to the tramways renewals fund and £4,672 for loan charges.

Swansea.—Progress Statistics.—At the last meeting of the Electricity Committee, Mr. J. W. Burr, the Corporation electrical engineer, submitted comparative statistics showing the progress of the undertaking in 1916-17 and 1917-18. The total units sold in 1917-18 amounted to 5,956,514, as compared with 4,975,475 in 1916-17. Coal consumption per unit generated, 2·74 lb., 1917-18, as compared with 2·816 lb. in the previous year. The Committee recommended the installation of a small overhead runaway, at a cost of £200, in the boiler house, preparatory to the installing of a coal conveyor at the generating station.

Tavistock. — Workhouse Lighting. — The Board of Guardians, at its annual meeting last week, decided to adopt electric lighting for the workhouse.

TRAMWAY AND RAILWAY NOTES.

Belfast.—Wages.—A curious situation has arisen over the Corporation tramways, a number of the employés having complained to the Irish General Munitions Tribunal that the Corporation had not complied with an award granting an increase of 6s. weekly wages. Mr. Lewis, for the Corporation, explained before the Tribunal on Saturday, that they could not legally carry out the award, their Act of Parliament requiring that expenditure must be kept within revenue. After taxing working expenses to the utmost, and exalting the revenue to the highest possible point, there would be a net annual loss of between £20,000 and £30,000 if the award, which affected 800 men, was complied with. The facts had been placed before the Ministry of Munitions, a Parliamentary Committee had been appointed, and would sit next week, and he was hopeful that a satisfactory solution might be arrived at. Previous increases in wages had placed a burden of nearly £40,000 on the tramways. The hearing was adjourned for a fortnight.—*Daily Telegraph.*

Blackburn. — Service Reduction.—The Corporation Tramways Committee will shortly be compelled to reduce its car service in order to economise. The service would be cut down at a time which would cause the least inconvenience to the public. A statement was made that the profit on the tramways last year was about £5,000. This was not a profit in the true sense of the word, but represented a saving mainly due to the fact that they had not spent money on the permanent way, through inability to get rails.

Blackpool.—Sunday Service.—To assist in economy, the Blackpool Corporation tramways department, Blackpool and Fleetwood Tramways Co., and Blackpool, Lytham, and St. Anne's Tramways Co., for the first time in 20 years, suspended on May 5th their Sunday morning services.

Year's Working.—Mr. Charles Furness, the tramways manager, reports that during the past year the income was £119,339, as compared with £96,224 a year ago, the highest ever reached. Working expenses were £68,456, and the disposable balance £31,518, as compared with £21,182 the previous year. The total number of passengers carried was 20,277,535, as compared with 16,245,022 the previous year.

Bournemouth.—The working of the Corporation tramways last year resulted in a profit of £26,342, after paying £1,193, the deficit on the running of motor-'buses.

Bradford.—Fares Increase.—The Tramways Committee, last week, decided to recommend an all-round increase of 50 per cent. in fares, as from June 1st.

Canada.—The British Columbia Electric Railway Co. has received cable advice that the Parliament of British Columbia has granted full powers to the City of Vancouver to eliminate the Jitney competition, both in the City of Vancouver and between that city and New Westminster.

Women Drivers.—According to the *Times*, the Toronto Street Railway Co. has decided to employ women as conductors and drivers, at the same wages as men.

Cardiff.—Service Congestion.—The manager of the Corporation tramways recently made an appeal to users of the tramcars to do their shopping earlier, in order not to cause congestion at the times when the service is required for business men and workers. According to the *Engineer*, the manager has informed the Corporation Committee that ladies are the chief offenders, and that unless the position improves there would be no alternative but to exclude them from the cars, which would be reserved for people producing authority showing they were on work essential to the interests of the war.

Dublin.—Fares Revision. The Corporation and the Rathmines Urban Council have asked the United (Electric) Tramway Co. to furnish them with copies of the revised schedule of tramway fares, to which objection has been taken on the ground that, as alleged, it does not conform to the provision of a statute governing fares within a specific boundary.

The Dublin and Lucan Electric Tramway Co. has reduced its Sunday services.

Galway. — Tramway Sale.—The Urban Council is considering a proposal to take over the Galway and Salthill tramway, hitherto worked by a company by horse traction, and also the local electric lighting undertaking. The tramway company has recently been wound up voluntarily, and it is hoped it may be possible to work the system by electricity. The profits from May, 1911 to 1917 were £1,570, and the losses in the same period £1,550.

Halifax.—Service Reduction.—In reply to the B. of T.'s recommendation to tramway authorities to reduce services as much as possible, so as to economise labour and power, the Tramways Committee considers that, in view of the important industries of the town, it is inadvisable to make any further reduction. It is also considered, by a majority of the Committee, that the Sunday afternoon and evening service should be maintained, as the public need the facilities for relaxation.

Huddersfield.—Women Drivers.—The local branch of the Amalgamated Association of Tramway and Vehicle Workers has unanimously passed the following resolution in connection with the training of women as drivers on the local system :—

> (a) That in the interests of the department, and for the safety and protection of the travelling public, we enter into a strong protest against the minute of the Tramways Committee (*i.e.*, women drivers), after taking into consideration the local conditions with regard to the heavy gradients that appertain in this locality, and in the interests of women's future health.
>
> (b) That under no consideration are we prepared to undertake the responsibility of training the women as tramcar drivers.
>
> (c) That in the event of the Tramways Committee insisting on the introduction of women as tramcar drivers, we pledge ourselves to use all and every legitimate means to oppose the introduction of females as drivers.

Hyde.—Tramways Purchase.—The report of the Oldham, Ashton, and Hyde Electric Tramway Co. states that in January last the Hyde Corporation gave notice that it intended to exercise its powers to purchase the company's tramways, about 1 mile 5 furlongs, in its area, and negotiations are now proceeding. The other local authorities, in whose areas the remainder of the track, about 6 miles 2 furlongs, is situated, have applied to the Board of Trade and were granted an order extending until February, 1919, the period during which they were entitled to give notice to purchase the company's undertaking within their districts. They have since applied for approval to serve notices of purchase.

Lancashire, Cheshire, and N. Wales Tramways.—The B. of T. Advisory Committee which is dealing with the tramway traffic question in the Lancashire, Cheshire, and N. Wales areas, met in Liverpool last week, with Mr. Mallins, general manager, Liverpool Corporation tramways, in the chair. A Sub-Committee was appointed to inquire as to the cost of each undertaking, with a view to effecting economies in the various services. It is not anticipated that the services in Manchester and Liverpool will be much affected, if at all, in view of the Government work in both cities.

Leeds.—Rate Aid.—The City Council recommends that in future the payments from the tramway undertaking in aid of the rates shall be based on £450 per annum per mile of single tramway track, and £200 per annum per mile of railless route. It was stated that labour alone had accounted for £90,500 more in the accounts this year than in the year before the war, in addition to which £12,000 was being paid this year to dependents of men on war service. All other costs had increased correspondingly, and against this increased cost they could set increased receipts to the extent of £79,000, but that could hardly be expected to be maintained under the restricted service which was to be enforced. Further, during the next five years £80,000 annually ought to be set aside for renewals after the war.

Leicester.—Year's Working.—The annual report of the Corporation tramways for the year ending December 31st, 1917, shows a total revenue of £243,648, an increase of £27,377. The passengers carried were 40,763,811, a decrease of 1,468,827, and the cars ran 3,824,657 miles, a decrease of 283,646 on the previous year. The total receipts averaged 15·289d. per mile, as against 12·634d. last year. There has been an increase in passenger receipts of £15,680 over the year 1916, and the working expenses amounted to £172,583, an increase of £19,629. The gross profits amount to £71,065, against £63,316 last year, and interest, sinking fund, income-tax, bank interest, and war allowance to employés in H.M. Forces, &c., were £61,744, an increase of £427, leaving a net balance to the credit of appropriation account of £9,320. Speaking generally, the permanent way is in good running order, although certain renewals will have to be carried out in the near future. The cost of general repair work and maintenance for the year is £5,639, and in addition £709 has been spent on renewals.

London.—L.U.T.—Commencing May 12th, Sunday cars on the London United Electric Tramways will not begin running until about 2 o'clock in the afternoon.

Fare Revision.—The L.C.C. Highway Committee reports that the estimates for 1918-19 of the working of the Council's tramway undertaking show that the revenue will be insufficient to meet the requirements of the year by £205,290; including the additional charge of £113,000, the increased war wages of employés in the traffic section, but without making provision for renewals, on which the general manager advises that a sum of £125,000 must be spent this year as a matter of urgency, the total additional revenue required to prevent a deficiency is approximately £330,290. Working expenses are estimated for the current financial year at 10·98d. per car-mile (against 8·22d. in 1916-17 and 6·47d. in 1913-14), apart from the payment of war-service allowances of £120,000. The main features of the proposed revision are as follows :—

1. Revision of 1d., 2d., and 3d. Fares.—The average length of the 1d. stage should be reduced from approximately two miles to 1·8 miles. The stages should be divided, as at present in most cases, into three sections. The length of the 2d. stage should be six of such sections and of the 3d. stage nine sections. The maximum fare for a continuous journey on one car should be 4d.
2. Suspension of 1½d. and 2½d. fares.
3. Suspension of ordinary transfer fares.
4. Suspension of children's reduced fares.
5. Revision of Workmen's Fares.—Single tickets to be issued at 1d. for four consecutive sections on one car, and at 2d. for any distance on one car with transfers as now given for 1d. single. Return tickets to be issued at 2d. for a journey in each direction over four consecutive sections on one car; both journeys to be made over the same sections.

Return tickets to be issued at 3d. for any distance on one car, with transfers as now given for 2d. return. The availability of return tickets to remain unaltered.

The present division of the Woolwich route into sections to be retained, so that passengers now paying 2d. would pay 3d. and passengers now paying 4d. would pay 6d.

The average distance that a 1d. single workman passenger could travel would be 2·4 miles, or 4·8 miles for 2d. return.

The revision of fares will afford opportunities of simplifying the ticket system, with resultant savings in working costs and improved fare collection; the economies in working costs and the increased revenue from improved fare collection are estimated to represent about £40,000 a year, or 12 per cent. of the estimated additional requirements for the current year.

The general manager advises that the increased revenue to be anticipated from all sources may be expected to meet the deficiency balance and the cost of renewals in the current financial year, provided that the changes are brought into operation at an early date.

Morley.—Fare Increase.—The T.C., at its meeting last week, expressed surprise that the Leeds City Council intended to increase the tramway fares—which affect Morley—by 50 per cent., and protested against the increase in view of the large profits handed to the Leeds ratepayers by the tramway undertaking. It was further suggested by the resolution that if any alteration were made the distances should be revised.

Oldham.—Year's Working.—There is a net profit of £5,808 on the tramway undertaking for the past year.

Rotherham.—Year's Working.—The total receipts of the Corporation tramways for the year amounted to £83,307. The gross profit was £20,591, as compared with £25,070 for the previous year. The net surplus amounted to £5,633, a decrease of £6,644 as compared with 1916-17.

Salford.—Fare Revision.—In support of an increase in fares, Alderman Linsley stated that early in the year the Council agreed to additional bonuses and increased wages amounting to about £25,000, and during the last three years the expenditure had increased by about £115,000. The increased fares, even if they provided £25,000, would only pay for the recent increase, and the workers were already asking for another advance. The revised scale was approved.

Stoke-on-Trent.—The Council has declined to seal the agreement with the Potteries Electric Traction Co., giving the company a renewal of its tenure of the tramways and light railways in the borough until 1932.

United States.—It is proposed in America to save 1,500,000 tons of coal a year by a "skip-stop" order reducing the number of tramway stopping places by one-third, as a necessary war economy.

The same question has been under consideration by the Tramways (B. of T.) Committee in this country, which is urging that the number of stopping places shall be reduced. This would have an important influence on fuel economy, and would also give a better service in regard to speed and convenience.

Fire.—A fire has destroyed a portion of the power plant of the Great Lakes Power Co. at Sault Ste. Marie, Ontario, with a loss of £3,000.—*The Times.*

TELEGRAPH AND TELEPHONE NOTES.

Germany.—It is announced from Berlin that the Drahtlose Uebersee Verkehr A.G. has been formed there with a share capital of £500,000 for the establishment of a wireless news service, the large station at Nauen being incorporated in the new company. The shares have been taken over by the Gesellschaft für Drahtlose Telegraphie and its associated electrical companies. The directors are Count von Arco, Dr. Franke (Siemens & Halske Co.), bank director Heinemann (Deutsche Bank), Commercial Councillor Mamroth (A.E.G.), and W. Muller (Dresden Bank). Herr Hans Bredow, of Berlin, is the managing engineer. It is not proposed to introduce the company's shares on the Stock Exchange.

In a notice of the German wireless station at Nauen, the pro-German Spanish paper *Industria e Invenciones* states that, whereas in 1914 this station dispatched only some 150,000 words, chiefly to America, in 1915 it forwarded 1,330,000 words; in 1916 it transmitted 2,580,000, and up to September last, the figures reached were 5,650,000 words. The speed of transmission, which at the beginning was only 100 words per minute, attained 250 words at the later dates. As Germany in the latter years was practically cut off from three-quarters of the world, these increased figures, if correct, must refer to Germany's notorious efforts at propaganda by means of the wireless system.

Spain.—The first wireless telegraph and telephone installation on board a Spanish merchant steamer, the *Rey Jaime I*, has just been completed. The system adopted is American, but the plant has been manufactured in Spain. A second steamer, the *Lulio*, is being equipped with a similar plant. The range of the installation is 300 miles for radiotelegraphic purposes, and half this range for radiotelephony. If the trials of radiotelephonic communication between ship and ship prove successful, a land station will be built at Barcelona, which will be linked up with the city and suburban network, and thus afford means of communication between land stations and ships on the high seas.—*Industria e Invenciones.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island Sydney. Director of Navy Contracts, Melbourne.

Brisbane.—July 1st. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary the Treasury, Brisbane.

Hoylake and West Kirby.—May 11th. Supply, &c., for one year to March 31st, 1919, of metallic filament lamps. Particulars from R. Williams, Clerk to Council, Town Hall, Hoylake.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

H.M. Office of Works. May 10th. Supply of main switches. See "Official Notices" May 3rd.

Redditch.—May 13th. U.D.C. Turbo-alternator, cooling tower, switchgear, water-tube boiler, &c. See "Official Notices," April 26th.

Warrington. — May 22nd. Electricity and Tramways Committee. Motors and transformers. See "Official Notices" May 3rd.

CLOSED.

Manchester.—Electricity Committee. Accepted tenders :

Mather & Platt, Ltd.—One 150-b.h.p., three-phase induction motor and switchgear.

F. Morton & Co., Ltd.—Steelwork required for 20,000-kw. turbo-generator, Stuart Street.

Callender's Cable Co.—Supply and laying of 33,000-volt cables.

Ferranti, Ltd.—Two 3,000-k.v.a., three-phase static transformers for sub-station.

W. T. Glover & Co., Ltd., and Western Electric Co., Ltd.—Supply of cable.

Sheffield.—City Council. Edmund Taylor, Ltd. Excavations and the construction of a concrete and brick tank for oil storage for the electricity department, also the construction of a switchboard for distribution switchgear on the siding at Neepsend at schedule rates ; cost £500.

Spain.—Messrs. Escher, Wyss & Co., of Zurich, have lately secured a contract from the Sociedad Riegos y Fuerza del Ebro for three spiral Francis turbines for its new hydro-electric station near Camaraca in the Pyrenees. The turbines, which are to be of the vertical shaft type, direct coupled to the generators, will each be of 18,000-h.p. capacity when running at a speed of 375 r.p.m.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, May 10th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

London Association of Foremen Engineers.—Saturday, May 11th. At 6 p.m. At the Cannon Street Hotel, E.C. 65th Anniversary Festival.

Junior Institution of Engineers.—Saturday, May 11th. At 3 p.m. At the Holborn Restaurant (Venetian Chamber). Bohemian Concert.

North-Eastern Section.—Tuesday, May 14th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "Stores Organisation," by Mr. E. F. Oakford.

Birmingham and District Electric Club.—Saturday, May 11th. At 7 p.m. At the Swan Hotel, New Street. Paper on "Electric Lifts," by Mr. C. G. A. Macdonald.

Illuminating Engineering Society.—Tuesday, May 14th. At 6.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Discussion on "The Lighting, Heating, and Power Order (1918), and the Best Methods of Making Economies."

Institution of Electrical Engineers.—(Students' Section).—Wednesday, May 15th. At 7 p.m. At Finsbury Technical College, Leonard Street, E.C. Paper on "Electric Railway Traction," by Mr. G. H. Fletcher.

Electrical Power Engineers' Association (Northern Division).—Thursday, May 16th. At the Grosvenor Hotel, Deansgate, Manchester. At 7.30 p.m. General meeting.

NOTES.

The Electrical Contractors' Association.—The *Electrical Contractor* publishes the following report on the work of the Association during 1917 :—"During the year just ended the work of the Electrical Contractors' Association (Incorporated) has been principally confined to dealing with various Government authorities appointed to deal with the general trade of the country. Many interviews have been held with the Department controlling the priority of copper, steel and cables, and the views of members have been clearly set forth in the question of exemptions from the Army, also the views of the Association have been asked for and considered. The Special Committee appointed to report on the electrical trade after the war received two deputations to consider the question of municipal retail trading, and also the suggestion that all electrical contractors dealing in and erecting electrical apparatus requiring more than 25 volts should be registered by some competent authority. With regard to fair trading, a Joint Committee of the various sub-contracting trades was appointed to discuss and draw up clauses in contracts protecting the sub-contractor as against the principal contractor. Many meetings of this Sub-Committee have been held, and reports made from time to time to the Council. The question of apprentices is now being considered by a Committee of the Council, especially that part relating to the return of apprentices after the war. With regard to municipal retail trading, very little under this heading has been done owing to the municipal authorities not being in a position to embark on such work, but, where cases have been reported, they have been dealt with satisfactorily. During the year the membership of the Association has increased by 40 new members, and about 10 firms have resigned, or been struck off, the list."

Volunteer Notes.—London Army Troops Companies' Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending May 20th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Captain W. Hynam.

Next for Duty.—Capt. W. D. Bentley.

Monday, May 13th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, May 14th.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 15th.—No. 1 Company, Entrenchments, Revetments, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, May 16th.—No. 2 Company, Entrenchments, Revetments, &c., 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. Band Practice, 7.

Friday, May 17th.—Musketry for the whole Corps, 2.45—4.45.

Saturday, May 18th.—Knotting, Lashing, &c., for the whole Corps, 2.45—4.45. Musketry, 2.45—4.45.

Sunday, May 19th, and Monday, May 20th.—Commandant's Parades at Waterloo Station, 8.45 a.m., for work at Esher. Dress, Marching Order, with rifles. Mid-day and tea rations to be carried.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Siemens Bros. & Co., Ltd., Reconstitution.—Rumours having been circulated to the effect that the enemy-owned shares in Siemens Bros. & Co., Ltd., had been purchased by the Vickers-Metropolitan-Westinghouse group, a full statement appears in the *Birmingham Daily Post* of May 3rd denying that the report has any foundation, and stating the facts in the following terms :—

"The actual position is that Siemens Bros. has not been sold by the Public Trustee, and is not for sale, but certain shares in the company which before the war were held in Germany, were vested in the Public Trustee, and these only have been sold. After prolonged negotiations, these were recently transferred to a group of English financiers, but not to persons having any connection with the Westinghouse Co. or the Metropolitan or any of the allied companies. The financial group who have bought the shares from the Public Trustee are a syndicate represented by Messrs. C. Birch, Crisp & Co., of London. The Board has been reconstituted, and the directors are now Sir Wm. Bull, M.P. (chairman of J. W. Singer and Sons), Sir Clifford J. Cory, Bart., M.P. (a director of the Barry Railway Co. and chairman of several colliery undertakings), Lord Queenborough (a director of A. Darracq & Co. and other firms), Mr. G. Mure Ritchie (chairman of the Blaenavon Co., Ltd., the Barrow Hematite Steel Co., and others), Mr. J. H. Thomas (stockbroker, Cardiff, a director of upwards of 20 companies), and Mr. G. Chauvin (managing director of Siemens Bros. and director of the West India and Panama Telegraph Co.). Great care has been taken in the sale of the shares that no one should be allowed to purchase who could bring about amalgamation with any other electrical concern, and under the new control the business will remain independent. It was recently stated in the House of Commons by Sir Albert Stanley that no company had been formed for purchasing the shares, and it may be further added that the articles of association are now in such a form that the control of the company can only be vested in British subjects. The Public Trustee required an assurance before the sale that the purchasers would carry on the business as in the past, and this was given. The company was registered in December, 1880, to take over the business of telegraph engineers, &c., of Messrs. Siemens Bros. The capital is £600,000 in fully-paid shares of £5, and there is a 4 per cent. debenture stock (part of £300,000 authorised) for £150,000. Dividends of 7 per cent. were paid in 1914 and 1916, of 6 per cent. in 1915, and 10 per cent. last year."

Electric Power Reform.—The British Empire Producers' Organisation understands that the Board of Trade Committee on Electric Power Supply will shortly present its report, and it is to be hoped that its recommendations will be made public with the least possible delay.

Home-Produced Oil. — Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, replying to a question as to the number of modified plants for the distillation of petroleum from cannel coal now in operation at gasworks in Great Britain, and what production had been obtained to date, said it was not desirable in the public interest to give details of production, but it might be stated definitely that gasworks in Great Britain were either now modified or in process of modification to enable all the cannel coal which was known to be available to be carbonised for the production of oil. The process so far had been an unqualified success, and the results were even better than were expected.—*The Times.*

Appointments Vacant.—Assistant shift engineer for Bury (63s. 3d.) ; charge engineer for Norwich ; car-shed superintendent for Dumbarton ; tramway repairs assistant for the Dumbarton Burgh and County Tramways Co., Ltd. ; charge engineer for the Dover Corporation Electricity Department ; engineer-in-charge (£200) for the Sunderland Corporation Electricity Works ; mains assistant (55s.) for Heywood Corporation Electricity and Tramway Departments ; electrical engineer for the Bettws-y-coed U.D.C. electricity undertaking. See our advertisement pages to-day.

Nickel-Copper Steel.—In a paper read by Mr. R. W. Leonard before the Canadian Society of Civil Engineers, particulars are given of an alloy steel made with copper ore mined in the Sudbury district, which contains a substantial proportion of nickel. The process of separating the nickel from the copper involved the waste of great quantities of sulphur and iron ; experiments were, therefore, made by Mr. G. M. Colvocoresses on the production of nickel-copper steel direct from the ores, which, after roasting, were smelted to pig in a Héroult electric furnace and afterwards refined. Immense deposits of the ore are available. It is claimed that the nickel-copper steel gives excellent mechanical test results, and is also less liable to corrosion than nickel steel.

The Metric System.—Suggesting that the last paragraph of our leaderette of last week, on the Metric System, is "just a little abusive and hysterical," an engineering correspondent who has spent many years in countries where the metric system was compulsory points out that those countries "do not manufacture their goods *for sale in this country* to our inches, pounds, or gallons." He goes on: "*I* can MAKE a thing according to English measures and SELL it in French, or German, or Russian. Mind you, *I know* what a useful thing (to me) is the Decimal (and Metric) System; but that isn't the point! I, who have used (and still use) *both* English and metric measures, *do not see the good* of compelling an English workman to use anything but inches and fractions of inches."

We are glad that our critic acknowledges the value of the decimal system to himself; evidently his objection to its adoption is founded not upon a lack of appreciation for its merits, nor upon a sentimental affection for our national peculiarities in this connection, but, with admirable altruism, upon solicitude for the right of the English workman to use inches if he wants to—even though by so doing the workman deprives himself of the advantages which our correspondent admittedly derives from the use of the decimal (and metric) system. In passing, we may say that we believe the average British workman does not care a tinker's dam whether he works to English or metric measures; if he is using jigs or gauges he need not even know the dimensions of the work at all. But the main contention of our correspondent is that, while there is no difficulty whatever in selling goods in metric measures abroad, or English measures in this country, *the goods need not necessarily be manufactured* in metric measures. Quite so; we do not dispute this point for one moment. We are in full agreement with our correspondent on this point, as well as with the promoters of the draft Metric Bill of last year, which contained the following clause:—4. (*a*) "Provided that nothing in this Act shall affect the manufacture or use of any machinery, tool, pattern, sieve, template, or other article made by measures other than metric measures." As we pointed out on page 295 of our issue of March 16th, 1917, this means that while all buying and selling would have to be done in metric quantities, our existing weights and measures would continue to be used for manufacturing purposes by those who chose to use them. The point was further explained in our issue of March 23rd, 1917, page 314, and elsewhere from time to time.

It is quite a good plan to ascertain the facts before passing sentence on the accused.

Fuel Economies.—At the two days' session of the Canadian Society of Civil Engineers, held at Toronto a few days ago, the part to be played by electricity in solving Canada's fuel problem occupied a large proportion of the time. After dealing with the possibility of United States coal supplies being cut off, Mr. William Challis declared that the electrification of railways, especially terminals, with adjacent engine divisions, would save an enormous consumption of bituminous coal, and relieve the transportation system. Something like 9,000,000 tons of coal was consumed by the railroads in 1917: it would be possible to save two-thirds, at least, of this coal by the use of electric locomotives. The present *per capita* hydro-electric power development in Canada is larger than that of any other country except Norway. Mr. J. M. Robertson, of the Southern Canada Power Co., Montreal, in a paper on the possibilities of the relief of fuel consumption in Canadian industry by the increased use of hydro-electric energy, mentioned that Toronto's use of electricity was practically that of Montreal, and both these cities stood in the forefront of the great cities of North America in this respect. Mr. P. H. Mitchell declared that the present development of electric power did not render practicable the use of electricity as a heating agent. But with a possible population of 25,000,000 in 1969, with a population of 15,000,000 in the coal area of central Canada, the exhaustion of other sources and increasing prices would compel the adoption of electricity for heating purposes. Mr. John Murphy, chief electrical engineer of the Department of Railways and Canals, Ottawa, in a paper on "Railway Electrification," gave a number of concrete instances to show where the electrification of railways in mountain sections had increased their efficiency. Prof. Peter Gillespie, School of Practical Science, said that 2 million H.P. would be required to heat electrically Toronto's buildings, housing a population of 500,000 people.

Answering questions in the House of Commons on Tuesday last, Sir A. Stanley stated that steps were being taken to ensure that all coke produced should be used, and that corresponding economies should be effected throughout the country in the consumption of coal. He was considering whether in rationing coal it might not be practicable to take into account the consumption of gas for heating and cooking purposes, but must warn householders that, whether their fuel was in the form of coal or gas, a very material reduction in consumption was absolutely necessary.

Hastings Linking-up Scheme.—Mr. Russell Ferguson, the Hastings borough electrical engineer, has had under consideration for some time a scheme for the centralisation of electricity supplies within a radius of 12 or 15 miles of the town. Last June he submitted to the Board of Trade, with the consent of his Committee, a full statement as to his proposals, which are that the Board of Trade should give the Hastings Corporation power to supply the area extending halfway to Eastbourne, and about the same distance from Maidstone. This area could be supplied from a bulk supply power station put down at the west end of the Borough of Hastings, alongside of the L.B. & S.C. Railway, on ground partly belonging to the Corporation, close to the sea, thus having available an unlimited supply of water for condensing purposes. This would give a bulk supply to Bexhill, the Hastings and District Tramways Co., and also the Hastings generating station, which would be turned into the principal distributing station for the area. If any of the small places round about wished for a supply of electricity, the supply could be taken overhead to static transformer sub-stations, and distributed from there. The plant proposed to be put down would have a standard voltage of 3,300 or multiples, 50 periods, three-phase. Should super-bulk supply works be erected at some future time, say, for instance, at the Kent coalfields, to supply all the South-Eastern district, Hastings would be able to take the supply from them and distribute it in the area already referred to. The great bulk of the house coal used in Hastings, St. Leonards, and Bexhill could be brought close to the proposed site for the new works, and treated at a low temperature, recovering the gas and residuals, the gas being used for generating steam at the new power works; the partly-coked coal could be sold at a much cheaper rate to the ratepayers, by this means doing away with smoke. The residuals would not be wasted, as they are at the present time.

Electrical Power Engineers' Association.—We are informed that there has recently been a large influx to the above Association of engineers engaged with electrical manufacturers throughout England. A desire has been expressed that they should have opportunities for meeting further than are meanwhile offered, and to this end there was successfully inaugurated last week the East London Manufacturing Section of the E.P.E.A. There was a large attendance of members of the technical staffs of electrical engineering firms in that district. Mr. G. F. Dewynter was elected chairman and Mr. E. Barnard honorary secretary, with a Committee of four. This section will be represented on the Divisional Council by its honorary secretary. Similar sections in other areas are in prospect, and one will shortly be formed at Hayes. It is believed that this branch of the Association's activities will in the near future become strong and influential. Membership is open to all qualified engineers engaged on power plants or with electrical manufacturing and contracting firms.

Scientific Congress.—The annual congress of the South-Eastern Union of Scientific Societies will be held in London on May 29th—June 1st. The hon. secretary is Mr. H. N. Gray, 334, Commercial Road, E. 1.

Institution and Lecture Notes.—Institution of Civil Engineers.—At the annual general meeting, on April 23rd, the result of the ballot for the election of officers for the year 1918-19 was declared as follows:—President, Sir John A. F. Aspinall; vice-presidents, Sir John P. Griffith, Mr. John A. Brodie, Mr. W. B. Worthington, and Dr. W. H. Maw. Other Members of Council included Sir Dugald Clerk, Col. R. E. B. Crompton, Sir Archibald Denny, Sir Robert A. Hadfield, Mr. Summers Hunter, Mr. Basil Mott, Vice-Admiral Sir Henry J. Oram, Capt. H. Riall Sankey, and Sir John F. C. Snell.

Association of Mining Electrical Engineers.—At a meeting of the Yorkshire Branch of the Association, at Wakefield, the question of increasing the coal output was discussed in relation to the provision of efficient signalling apparatus. A paper, by Mr. W. de M. Landon, A.M.I.E.E., described an interrupter system, with relays, which could be worked with a single wire, and which the author claimed to be positive in action, inexpensive, simple and efficient, and perfectly safe, inasmuch as it worked on a 6-volt circuit. The system is in operation in a number of Lancashire collieries. The important bearing that quick and efficient signalling, especially in connection with haulage, has on making possible the more rapid handling of coal, and, consequently, on increasing output, was emphasised.—*Sheffield Telegraph.*

The West of Scotland Branch has elected Mr. A. Smellie as president and Mr. D. Landale Frew secretary. On Saturday last the following papers were to be read:—"Organisation of Electrical Repairs," by Mr. J. McCann, and "Electrical Breakdowns and their Cause," by Mr. F. A. Hale.

Junior Institution of Engineers.—"The Electric Furnace" was the subject of a lecture given by Mr. Verdon O. Cutts before the Sheffield and District Section of the Institution. Several applications of electrical furnaces of particular interest to Sheffield were reviewed by Mr. Cutts, the chief being the manufacture of steel from scrap. He also dealt with the manufacture of ferro-alloys, and with furnaces for non-ferrous metals and alloys, and for hardening, tempering, forging, annnealing, and heat treatment. The details given were based on the lecturer's personal experiences during the war.—*Sheffield Telegraph.*

Institution of Electrical Engineers.—At a meeting of the NEWCASTLE LOCAL SECTION, on the 6th inst., Mr. H. W. Clothier presiding, an informal discussion was held upon the Ship Electrical Equipment Committee's draft regulations.

Royal Marine Engineers.—The Secretary of the Institution of Civil Engineers is informed that the Admiralty are open to receive applications from gentlemen for commissions as Lieutenants in the Royal Marine Engineers. This branch of the Royal Marine Corps has been formed with a view to the rapid execution of constructional engineering work. Candidates should have previous practical experience on civil engineering works, and be capable of setting out work and controlling men. Candidates up to 50 years of age will be considered, but those under 35 should have a lower medical category than Grade 1. Pay and allowances will be at the rate authorised for the Royal Engineers, and the usual outfit allowance will be granted. Applications, with copies of testimonials, and particulars of experience, should be addressed to the Adjutant General, Royal Marines, Admiralty, S.W. 1.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Controller of Coal Mines, having asked Blackburn Corporation to nominate a qualified person to undertake the work of inspection of various works and factories in this locality in connection with the economy in coal consumption, the Town Council has authorised Mr. P. P. Wheelwright, the borough electrical engineer, to act in this capacity.

The Dublin Corporation has appointed Mr. B. Muntz consumers' installation engineer in room of the late Mr. Edward, with Mr. L. O'Connor as assistant.

The Admiralty has acceded to the request of the Doncaster Electric and Tramways Committee for the release of Mr. E. S. Raynor to resume his duties as electrical and tramways manager, at £550 par annum. Mr. Potts was complimented on the way in which he had "carried on" in the department in the absence of the manager.

Bingley District Council has advanced the salary of its electrical engineer, Mr. F. L. Pedley, from £185 to £190, and the salaries of other official on a similar generous scale.

Mr. F. H. Hitch, engineer-in-charge at the Hammersmith B.C. electricity works, has resigned, having obtained an appointment with the National Boiler & Insurance Co. Since the meter superintendent, Mr. Ashton, resigned last November, it has not been possible to secure a successor of non-military age. Mr. W. Cook, the canvasser, took over the work in the meter department, and this arrangement is to be continued until the return of the permanent meter superintendent, Mr. W. H. R. Watts, who is on military service. Some of Mr. Cook's work will be done by Mr. J. Day, who has been acting as mains superintendent. The salaries of Messrs. Cook and Day, including war allowances, are now raised to £5 5s. per week each.

General.—Mr. H. Cobden Turner, of the British Westinghouse Electrical & Manufacturing Co., Ltd., has been appointed manager of Salford Electrical Instruments, Ltd.

Messrs. Electro-Bleach & By-Products, Ltd., announce that Mr. Robert E. Moynihan has left their employ.

Roll of Honour.—We are sure that all of our readers will desire to join with us in expressing deep sympathy with Sir Charles and Lady Parsons in the loss they have sustained by the death of their only son, Major Algernon George Parsons, R.F.A., who was killed in France on April 26th, aged 32 years. Major Parsons was a director of the Parsons Marine Steam Turbine Works, Ltd., and of Messrs. C. A. Parsons & Co.

The *Times*, in announcing the death of Captain G. Trevor Williams, R.F.A., aged 30, through an accident, states that after leaving Armstrong College, Newcastle-on-Tyne, he had two years' practical experience in the electrical works of Messrs. Chas. A. Parsons & Co., whence he proceeded to Trinity College, Cambridge, for a course of research work, and was associated with Prof. Hopkinson in a paper read before the Royal Society. From Cambridge he was appointed to an important post with Messrs. Chance Bros., Birmingham, and was with them when war broke out.

Private J. Standish, Middlesex Regiment, formerly on the staff of the Burslem electricity works, has died on active service.

Lance-Corporal Mynett, South Staffs. Regiment, reported missing, was on the staff at the B.T.H. Works.

Sergeant R. C. Williams, who was on the staff of Mr. J. B. Saunders, electrical engineering contractor to the Cambrian Railway Co., Welshpool, is a prisoner of war at Cassel, Germany.

Sergeant W. H. Atkin, M.M., R.E., who has fallen in action, was an electrician with Messrs. Bolckow, Vaughan and Co., Ltd., Middlesbrough.

The Military Medal for gallantry in action has been awarded to Bombardier G. Pitt, who was with the Bath Electric Tramway Co.

Rifleman C. H. Dodimead, of the 16th Battalion Rifle Brigade, only son of Mr. C. E. Dodimead, of Messrs. J. Dodimead & Son, who has been missing since the German advance of March 21st, is a prisoner in Germany. He has been in France since November, 1916, and has twice been in hospital, from shrapnel wound and trench fever.

Private R. Standish, L.N.L. Regiment, killed in action, was employed at Bolton Corporation electricity works.

The death in action is presumed, after being reported missing since July last, of Private J. Smith, Cheshire Regiment, aged 24 years, who was employed by Messrs. Dick, Kerr and Co., of Preston.

Lieutenant George Proctor, Lancashire Fusiliers, killed in action, was apprenticed with Messrs. Rushworth, electrical engineers, of Colne.

The Military Medal has been awarded to Lance-Corporal E. Holway, R.M.L.I., who was on the electrical staff of the Theatre Royal, Halifax.

Private J. Marriott, R.A.M.C., who has been gassed, was with Messrs. J. W. & R. Graham, electricians, Huddersfield.

Lance-Corporal W. G. Shuttleworth, missing since March 27th, was with the Keighley Electrical Co.

Second-Lieutenant J. J. Fawcett, Royal Inniskilling Fusiliers, missing, believed killed, was an electrical engineer with Mr. J. W. Buchanan, Londonderry.

The Military Medal has been awarded to Sapper E. O. Webber, Signal Section, R.N.D., who was in the Hull Corporation electricity department.

Corporal G. Page, M.M., killed in action, was employed by the electricity department of the Keighley Corporation. He was awarded the M.M. six weeks ago.

Lieutenant George Proctor, Lancashire Fusiliers, killed in action, aged 25 years, was with Messrs. Rushworth Bros., Ltd., electrical engineers, Colne.

Corporal W. Clough, R.F.A., who has been awarded the Military Medal, was formerly employed by the Tudor Accumulator Co., Ltd.

Obituary.—Mr. James W. Rook.—Mr. Rook, whose death we announced in our last issue, was very widely known and highly respected in the commercial electrical world. From the late eighties of last century to the year 1899 he was with Messrs. Crompton & Co., Ltd., at Chelmsford. He was in position of considerable responsibility in connection with the stores and purchasing department, and was commercial manager at Chelmsford when, in 1899, he joined the Sloan Electrical Co., Ltd., in London. With the latter firm he has been prominently identified from that date right down to his death, which took place suddenly on May 2nd at his residence at Southgate. Mr. Rook was a man of strong personality, and of qualities and abilities which were appreciated in electrical trade circles in the City of London. He devoted his attention chiefly to the carbon and lamp sections of the industry. He was 61 years of age.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

The annual meeting was held on Monday at Hamilton House. Mr. J. Annan Bryce, M.P., who presided, having referred to the principal figures in the balance sheet, turned to the profit and loss account. He said that the profit available for the year was £194,403, which compared with £311,199 in 1916, a falling off of £116,796, while the net profit of £88,124 compared with £199,346 in 1916, showing a decrease of £111,222. This result was due in part to the conditions in Russia, which had made it necessary to provide a considerable sum in respect of outstandings in that country. Moreover, it had been thought prudent to provide considerable sums for development and research work. In the future it would be necessary for them to devote large amounts of money to those purposes if they were not to fall behind in the race. In no industry were changes more rapid and more numerous than in their trade, and every day developments, requiring the expenditure of large funds in research and experiment, were taking place. In view of the keen competition which was before them after the war, it would be essential for them to keep abreast of the times, and he was afraid that they might have to look forward to the expenditure necessary having an appreciable effect on the extent of the profits. To return to the question of the diminished profit of the year 1917, the main causes had been those which he had been foreshadowing in his speeches since the war began, and the cumulative effect of which had become more marked as time went on. The labour position had become steadily worse. Not only was it exceedingly difficult to obtain labour at all, but that which they did get was not so efficient, while the cost of it had risen immensely. The difficulties, which had been particularly acute in 1917, seemed likely to continue. Since May of last year there had been a constant drain on their labour resources through the combing-out of semi-skilled and unskilled labour under the scheme of the Ministry of Munitions. Further depletions had been caused by the recall to the Colours of men returned from the Army for munition work, and they expected that their shops would be still further denuded by the calls of the military authorities under the revised schedule of protected occupations and under the Man-Power Act. Great difficulty was experienced in making good those losses owing to the all-round shortage of labour of the class required. Every possible effort had been, and was being, made to fill the gaps by discharged soldiers, but that source of supply did not furnish nearly enough men accustomed to their class of work. The difficulties might be gathered from the fact that since January 1st, 1917, to April 26th, 1918, there were engaged 2,931 men and 2,506 women. The cost of male labour was now 66 per cent., and that of female labour 100 per cent., above the cost of 1913, and these figures applied in the case of both sexes to the earnings of persons under 21 years, as well as to those of persons above that age. Then there had been continual and increasing difficulties in obtaining raw materials, even at the greatly enhanced prices which had been ruling. Many of those materials came from abroad, and, owing to tonnage difficulties, almost all of them were now under Government control, and had to be doled out often after long delays. Moreover, their work depended to a considerable extent on supplies of material from other manufacturers, who in many cases, labouring under similar Government restrictions, had been unable to keep deliveries at due date, with a resulting delay to, and increased cost of, the work in their own shops. The effect of all those adverse factors had been that completion of orders had had to be suspended and deliveries postponed, with the result that in many cases the estimates of cost had proved to be inadequate. Another cause adversely affecting profits had been the fact that a considerable part of their business had been Government work, in which margins were cut very fine. He hoped they might do better in the future. They had an excellent staff, who had met the unprecedented difficulties of their task with devotion and loyalty. After the war there would in their trade at least be an immense field for expansion, for not only would a great part of the world require reconstruction, but the experience and necessities of the war had shown that in this country one of the main elements of economy in its resources would be the development of electric power from large central stations. The report of one of the Government Reconstruction Committees estimated that 100 millions of pounds might be saved annually by the creation of such central stations. For such work they were well laid out. Until shipping restrictions began to impede their business, they were building up a good continental and export trade, and though it was suffering at present, it was to be hoped that it might recover and extend after the war, at least in the Oversea Dominions and Allied countries, where German manufactures would probably not be in so great favour as formerly. But there was no use disguising the fact that difficulties would be great. He had already spoken of the way in which expenditure on development and research might affect their profits, but there would be severe competition from America as well as Germany. The country would labour under an immense load of debt which could only be met by increased production, and increased production could only be secured by Labour and Capital uniting for a long pull, a strong pull, and a pull altogether. Excellent work in this direction was being done by the Works Committee, which was started in January, 1917. It had co-operated splendidly with the management, and on its advice, and with its assistance, many ameliorations had been effected in the conditions in the shops, and many difficulties with the workmen amicably settled. The operations of the Committee had produced a more harmonious feeling between the workers and the management, and, in view of the increased spirit of trust and mutual respect, the management looked forward with confidence to the assistance of the Committee in the handling of the difficult problems likely to be presented by demobilisation. Numerous inquiries had been received from large industrial concerns throughout the country for information about the constitution and operation of their Works Committee. At the last meeting he described to them their educational system, which, under the guidance of Mr. Fleming, had attained great success, and excited the attention of Mr. Fisher, the Minister of Education, as well as interest all over the country. That system continued in operation with the same success. Under the present conditions of military service they were losing at the age of 18 many of their potential engineers, but they might console themselves with the conviction that the training received at the works would, if the authorities had any intelligence, be of great service to the Army. Special classes were being run for women with the object of training them for real draughting work—many of them were already carrying out design work—and they expected that by this means the loss of their young draughtsmen would be made good. Much good research work had been accomplished during the year. The scope of the department had been considerably increased, and the equipment and personnel enlarged and strengthened. There was now under consideration a comprehensive scheme in connection with research and development, which were of essential importance to their success in the future. After referring to the position of the Employés' War Relief Fund, Mr. Bryce said that up to the present time there had joined His Majesty's Forces 3,206 of their men, of whom 233 had fallen. In connection with the entry of the new financial interests, changes in the board became necessary. Mr. Lang and Mr. Blunt had retired from the board, but their services were still at its disposal. To Mr. Lang, who had been in the service of the company since 1906, as works manager from July, 1906, to September, 1909, then as a director and managing director of works from September, 1909, to August, 1913, and as managing director from August, 1913, to February, 1918, had been very largely due the high position of the company. Through having obtained the confidence of the workers, they had all through his administration been able to avoid serious labour troubles, and his reputation for fairness had led to his being often asked to arbitrate in outside disputes. It was largely through his help that the company was able to pull through its dark days. The directors were glad that they had been able to retain at their disposal his great technical abilities. Mr. Blunt had been with the company since the start, and his great capacity as a sales manager had been of the highest value to them. He was happy to say that in his case, also, his abilities would remain at the service of the company. Three gentlemen had joined the board representing the new financial interests, viz., Sir Ernest V. Hiley, K.B.E., and Mr. Lincoln Chandler, of the Metropolitan Carriage, Wagon and Finance Co., Ltd. (the latter one of its managing directors), and Sir Francis H. Barker, of Messrs. Vickers, Ltd. The two former gentlemen had been elected by the board vice-chairman and managing director respectively. The abilities of all three gentlemen were well known in the industrial world, and he was confident that with their experience, and the support of the powerful concerns they represented, a great future was in store for the company.

Sir Ernest V. Hiley, in seconding the adoption of the report, said that as that was the first year the company had been free from American control he felt impelled to say a few words. There was no use disguising the fact that the results of the past year's trading had been distinctly disappointing. The chairman had alluded to the causes, but the fact remained that the net available profit was more than £111,000 less than it was at the end of 1916. When the representatives of the Metropolitan Carriage, &c., Co. and Messrs. Vickers took their seats on the board the results of the trading up to that time were very unpromising, and they created a feeling of uneasiness, which had not yet altogether disappeared, though, he was glad to say, there had been a welcome improvement in the recent returns—particularly in those for January and February of this year. He thought the board would have been justified in paying a less dividend than 7½ per cent., because to do so they had had to reduce the carry-forward to £51,000, which was little more than half of the amount brought forward. As to the future, they found that in the past it had been the practice to rely largely upon America for designs and improvements in apparatus. In the national interests they could not afford to do that any longer. That company was now British-owned, and it must stand on its own feet, and they intended to build up the business until it could take its place amongst the foremost industries of the world. Electrical enterprise had been too long in the hands of other nations. The chairman had already alluded to the keen competition they must expect from the Germans after the war. To cope with that they must be thoroughly up to date, and to that end the directors had decided to develop the department of research and scientific study. They found that the insufficiency of that department was a blot on the whole organisation of the company. Not only did it affect the English company, but the want of it was felt in the subsidiary companies in France and Italy. They could not create that department in a day, it must be built up gradually; but to make it effective the company must be prepared to spend money in no niggardly spirit, and he felt sure the shareholders would not grudge the necessary expense. In regard to the question of capital expenditure, last year they were warned that the board could foresee the necessity for increased capital expenditure, not only for that company, but for the subsidiary companies. When the capital of the foreign companies was increased it would be absolutely necessary for them to take up their proper proportion, as otherwise they would lose their voting control, and upon the maintenance of that control depended the whole organisation of the enterprise. The sums required would be large, and he was inclined to believe they could only be obtained from the ordinary shareholders. At the present time the capital of the company was very badly balanced. The preference shareholders greatly predominated, and there were two series of debentures already in existence. It would be undesirable to issue a third series, while the fact that the preference shareholders were entitled to a maximum dividend of 15 per cent. before the ordinary shareholders participated created a great difficulty with regard to the capital. Speaking as a representative of a majority of both classes of shareholders, he had no hesitation in saying that the capital needed redistributing. It was doubtful if a 15 per cent. dividend would ever be paid on the preference shares—indeed, it seemed quite possible that the present 7½ per cent. would not be maintained—and should it be necessary to raise money on mortgage or on debentures the interests of the preference shareholders would, of course, be postponed in favour of the new charge. To avoid that they would have to issue additional ordinary capital, but what would be the prospect of success if there were a large body of 15 per cent. preference shareholders in front of the ordinary, who had never yet received a penny in dividend? The holders of the majority of the preference shares were ready to face the position, and would agree to a curtailment of their privileges in the interests of the company. They had embarked a great deal of money in the enterprise which they did not want to lose, but it was largely on national grounds that they bought out the American interests. Having made the company a British concern in both ownership and management, they wanted it to succeed, and they felt quite sure that in that endeavour they would have the support of all shareholders. A scheme for a redistribution of the capital was in preparation, and as soon as it was ready it would be placed before the shareholders at a special meeting.

Mr. H. W. Birks remarked that such drastic proposals as those foreshadowed by the last speaker gave grave grounds for complaint that no mention was made of the subject in the report. The preference shareholders had already sacrificed £3 a share of their capital, and he believed that any scheme to further reduce the shares would meet with serious opposition.

The report was adopted.

Indo-European Telegraph Co., Ltd.

Mr. J. H. Tritton, presiding at the annual meeting on April 30th, said that the final figures for the year 1917 would be circulated as soon as they were available. The meeting approved a resolution declaring a final dividend of 22s. 6d., free of tax, making 7 per cent. for the year, with a distribution from equalisation of dividends fund of 30s. per share, subject to the terms of the Trading with the Enemy Proclamations. Mr. Tritton said that the arrangement come to with the Eastern Telegraph Co. and the Indo-European Telegraph Department of the Indian Government had applied to the whole of the year, whereas last year it covered only the last five months. Under that arrangement, those two telegraph administrations secured to this company a sufficient revenue to cover all working expenses and to pay a dividend of 7 per cent. upon the share capital of the company. The company's revenue from telegraph traffic was now comparatively small, and after adding to this the interest upon investments, there still remained a considerable sum of money which had been found by the administrations just referred to, and the company was deeply sensible of this generous treatment. He informed the shareholders at the last general meeting that it would lie with the directors to recommend any additional dividend by drawing upon the fund established for the equalisation of dividends. The directors had given this question their earnest consideration, and had decided to recommend that the total distribution for the year be brought up to the same level as in previous years by withdrawing £25,500 from the equalisation of dividends fund. The shareholders had some claim upon this fund, which was established during a series of prosperous years for this very purpose; these were hard times, and the directors were loth to reduce the dividend at a time when, in all probability, it was more urgently needed. He was unable to make any statement as to their wireless interest; the negotiations that were initiated last year were not yet concluded. The company's route remained interrupted between this country and Russia, and they were now having a good deal of trouble south of the Caucasus, owing to the unsettled state of the country lying between Tiflis and the Russo-Persian frontier. Their further plans must, of necessity, remain undecided until the war was over. The company completed 50 years of public service on April 8th, and they fully hoped and believed that once the war was over they would be able to re-establish telegraphic communication, and that the company would once more become a useful and active entity.

Nitrogen Products & Carbide Co., Ltd.—Final dividend 3 per cent., less tax, making 6 per cent. for the year. The Odda factory has worked satisfactorily, but production has been occasionally restricted owing to the difficulty of keeping stocks of raw material at the maximum under prevailing war conditions. The output was disposed of under agreements, which have expired, but fresh contracts have been entered into, which ensure the sale, at a remunerative price, of all cyanamide that can be manufactured during 1918. The Swedish works continue to give good results, and the demand for both carbide and cyanamide from that factory has been well maintained. Latest reports regarding the works for the production of nitric acid by the catalytic process state that the licensees are so satisfied with the process that further plants are being erected.

River Plate Electricity Co., Ltd.—In their report for 1917 the directors state that owing to practically all fuel tonnage between the United States and the Argentine having been commandeered, deliveries of oil fuel under the company's contract have been suspended since the commencement of the present year. In consequence the company is compelled to purchase any fuel obtainable in the market at the prevailing famine prices. The effect upon the current year's trading cannot fail to be most serious. No interest has been received upon the 5 per cent. obligations of the German Trans-Oceanic Electric Co.

North of Scotland Electric Light & Power Co., Ltd.—The working during 1917 showed a satisfactory result considering the conditions. Montrose connections increased from 1,091 KW. to 1,173 KW., Brechin from 815 to 837 KW., and Inverness from 1,597 to 1,784 KW., making a total of 3,794 KW. connected in the three towns. The gross profit was £6,642, against £7,550 for 1916. After deducting debenture and loan interest £2,620, and adding £2,177 brought forward, the net profit is £6,200. A dividend of 3 per cent. for the year is to be paid, £2,000 is to be placed to renewal reserve, £1,000 to general reserve, and £1,700 is to be carried forward.

Altrincham Electric Supply, Ltd.—During 1917, 33 new installations were connected. The profit was £6,536, plus £502 brought forward. After paying the preference dividend, putting £1,000 to reserve for income-tax, and £1,500 to depreciation of plant reserve, a dividend of 3s. 6d. per share was paid on the deferred shares. £5,000 debentures and £5,000 preference capital have been issued for plant and mains additions already carried out and for general purposes. We referred to the annual meeting in our last issue.

Companies Struck Off.—The following have been struck off the register and are dissolved:—

Bleicher's Aerial Transporters, Ltd.
British Graetzin Light, Ltd.
Eclipse Electric Sign Co., Ltd.
Magneto & Taximeter Co., Ltd.

Chiswick Electricity Supply Corporation, Ltd.—For 1917 the revenue was £31,143, against £20,523. The directors recommend a dividend on shares of 6 per cent., less tax, placing £1,400 to depreciation reserve fund account, and carrying forward £1,008.

Craigpark Electric Cable Co., Ltd.—Net profit for the year ended March, 1918, after providing for excess profits tax, £11,297, plus £716 brought forward. There is to be appropriated to depreciation off buildings and machinery £2,000, and to be put to reserve £3,000, 6 per cent. on the preference shares absorbs £2,850, and 6 per cent. on the ordinary £2,250, leaving £1,913 to carry forward, subject to directors' fees. The volume of business has been satisfactory, although production has been handicapped by shortage of labour and scarcity of materials.

Anglo-American Telegraph Co., Ltd.—The dividends on the ordinary preferred and deferred stocks for 1917 absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account, £71,428, includes £5,803 interest received, and the balance of £65,625 is available for the payment of March quarterly dividends.

British Ever-Ready Co., Ltd.—Final dividend on the preference shares at the rate of 10 per cent. per annum for the half-year to March 31st, making the maximum of 10 per cent. for the year. Final dividend on the ordinary shares at the rate of 10 per cent. per annum for the half-year, plus a bonus of 7½ per cent., making 17½ per cent. for the year.

Montreal Light, Heat & Power Co.—Dividend, 2 per cent. for the quarter to April 30th.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have shown a fair amount of buoyancy during the past few days. There is more business going on, and a greater excess of confidence has developed by reason of the news from the Western Front. With the general improvement in the prices of gilt-edged securities, including the debenture stocks of the home railway companies, there has also come a revival of interest in the more speculative stocks and shares. Almost the only market which is dull for the time being is that for rubber shares, where the companies have troubles peculiar to themselves. So far as other industrials are concerned, the retention of the Excess Profits Tax at its previous level is still held as a bull point, and has encouraged appetite for high-yielding issues. A sharp recovery in home railway ordinary stocks is another feature of the markets.

The principal advances secured by the stocks and shares quoted in our lists are those in the British Columbia Electric Railway descriptions. The four principal issues have gained 4 to 8 points apiece, thanks to the announcement that the British Columbia Parliament has granted full powers to the City of Vancouver to eliminate the jitney (motor-car) competition both in the City of Vancouver, and between that city and New Westminster. This has removed the factor which occasioned more anxiety than anything else in the minds of the British Columbia stockholders, and, as we have remarked lately, private advices from Vancouver speak hopefully of the greatly improved conditions that have latterly obtained in that city, and in the province as a whole with regard to general business.

Brazilian Tractions are also a better market, though the improvement in their case is limited to a point. Mexican and Anglo-Argentine shares and bonds remain on the heavy side, though there seems to be rather more disposition to look at Mexico Tramways bonds. The Argentine Tramways and Power Co. (which must not be confused with the Anglo-Argentine Tramways) publishes a progressive report showing that the net revenue for last year came to £15,000, an improvement of £1,600 as compared with the previous 12 months. The debenture interest is paid, but the preference shares still go without their dividend, which is now 18 per cent. in arrears. Georgia Light & Power common have weakened to 12½, although the annual report gives the net profits for 1917 as $117,600, an improvement of $30,000 over the 1916 figures.

The home railway market, as noted above, stands out with a good many rises. The Undergrounds are a better market, though they have not yet participated to any extent in the improvement which has occurred amongst the steam lines stocks. Underground Electric Income bonds have risen 1 to 75. Metropolitan gained ¼, and Districts keep steady, both being somewhat better than they look.

That the transport business of London is not all honey is shown by the annual reports issued by the London United Tramways and the Metropolitan Electric Tramways. The London United Tramways accounts show a loss of £9,000 for last year, as against £2,600 in the previous 12 months. The preference dividend is nearly 45 per cent. behindhand. The only hope of salvation would appear to be in a drastic reconstruction of the capital, and reorganisation, unless thrown out in Parliament, will probably be agreed upon. The Metropolitan Electric Tramways has done better, but the preference shares get only 2 per cent., instead of the 5 per cent. which they received a year ago. The preference shares last changed hands at 5s. at the end of April. London United Tramways debenture stock stands at 40, the last recorded bargain in the Stock Exchange Official List being at 38½ on April 4th, over a month ago. Raising of fares on the L.C.C. system would probably be followed by the same step on the L.U.T. and the M.E.T. cars, and this is regarded as being almost a certainty.

Cuba Submarine ordinary have risen to their par price of 10, and Oriental Telephones are 1/16 better at 4¼. With the exception of these, and a rise of ½ in Anglo-American Telegraph preferred, no particular change has occurred in this section. Marconis are keeping steady at 3⅛. American Marconis hardened to 23s. The Globe issues are firm. Nor is there any particular change in the prices of manufacturing shares. General Electric preference at 10¼ are ⅛ lower, while amongst the electrical manufacturing issues, Electric Constructions at 1⅛ are ⅛ down. British Westinghouse preference recovered further to 2⅝, to react later to 2½, as a result of the meeting on Monday, at which the chairman spoke of the probable necessity for shareholders to make some sort of sacrifice if reorganisation of the capital were to take place. Babcock ordinary hardened to 3 5/16. Rubber shares have weakened on the fall in the price of the produce to 2s. 3½d. per lb. The armament group, together with other iron and steel issues, make a firmer market. A striking feature of strength is afforded by the various lists of shares in companies connected with base metals, a sensational rise in the price of tin re-directing attention to Cornish, Malayan, and West African mining shares.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price May 7, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6¾	—	£7 8 0
Charing Cross Ordinary ..	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	8	5	3	—	8 6 8
City of London	8	8	12	—	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	—	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3⅛	—	8 0 0
Metropolitan	8	4	3⅛	— ⅛	6 8 1
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	93½xd	+ ½	6 8 4
do. Def.	38/6	1½	22¼	—	6 14 10
Chile Telephone	8	8	7⅜	—	5 8 4
Cuba Sub. Ord.	6	7	10	+ ¼	*7 0 0
Eastern Extension	8	8	15⅜	—	*5 4 1
Eastern Tel. Ord.	8	8	154	—	*5 4 0
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. Pref. ..	6	6	9¾	—	6 3 1
Great Northern Tel.	29	24	36½	—	6 11 6
Indo-European	18	18	51½	—	6 6 8
Marconi	10	15	3⅛	—	4 17 10
Oriental Telephone Ord. ..	10	10	4¼	+ 1/16	2 7 0
United R. Plate Tel.	8	8	7	—	*5 15 4
West India and Pan.	6d.	6d.	¾	—	*3 6 8
Western Telegraph	7	8	15⅜	—	*5 4 1

Home Rails.

Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	21	+ ¼	4 15 3
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A" ..	Nil	Nil	4/6	—	Nil
do. do. Income	6	4	75	+1	*5 6 8

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	— ⅛	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	2⅝	—	—
do. 2nd Pref. ..	5½	—	2⅛	—	—
do. 5 Deb. ..	5	5	63	—	7 16 4
Brazil Tractions	4	4	43	+1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	58½	+4	8 11 0
do. do. Preferred	Nil	Nil	38½	+6	Nil
do. do. Deferred	Nil	Nil	33	+7½	Nil
do. do. Deb.	4½	4½	63	+6	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	+1½	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	26½	—2½	Nil
do. 1st Bonds ..	Nil	Nil	36½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3 5/16	— 1/16	4 10 8
British Aluminium Ord. ..	7	10	1 9/16	—	6 8 0
British Insulated Ord.	17½	20	3⅝	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2½	—	6 0 0
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3½	—	5 14 2
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1⅛	— ⅛	6 13 4
Gen. Elec. Pref.	6	6	10¼	—	5 15 8
do. Ord.	10	10	20¼	—	4 18 9
Henley	25	25	19	—	6 6 7
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15⅝	—	*6 8 0
Telegraph Con.	20	20	42	—	*5 18 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£75	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	£5 inc.
a Copper Sulphate	"	£67 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£22 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	1/1	1d. inc.
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn) ..	"	1/7 to 1/7½	..
g " Bars (best selected) ..	per ton	£147	..
g " Sheet	"	£147	..
g " Rod	"	£147	..
d " (Electrolytic) Bars ..	"	£125	..
d " " Sheets ..	"	£152	..
d " " Wire Rods	"	£138	..
d " " H.C. Wire	per lb.	1/4	..
f Ebonite Rod	"	3/1	1d. inc.
f " Sheet	"	[illegible]	..
n German Silver Wire	"	[illegible]	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/2	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large ..	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/6,	3d. inc.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Valedictory Dinner to Mr. A. H. Seabrook. — O Friday evening, at the Restaurant Frascati, Oxford Street, W., complimentary dinner to Mr. A. H. Seabrook, M.I.E.E., M.I.Mech.E. general manager of the St. Marylebone electricity undertaking was given by Mr. Alderman Duncan Watson, and a very enjoyabl evening was spent, the Mayor of St. Marylebone, Alderman H. F New, J.P., presiding. It was expected that Sir John Snell woul be present, but he sent a letter expressing regret at being unavoidably prevented from attending. Alderman Duncan Watson proposed the toast of "Mr. Seabrook's Health," and spoke of his goo work and friendship during the long term of his association wit the undertaking. Mr. Seabroook, in replying to the toast, sai it might be thought strange by some that he was leaving th electricity department after being associated with St. Marylebon for so many years, and more especially so as he was leaving municipal undertaking to join a private firm. The war ha caused many changes to be made, however, and as to the future o the generation of electricity, he believed that present methods an customs would have to be entirely altered if we were to compet successfully with countries which possessed water powers. He ha for a number of years been interested in the recovery of by-product from coal before it was burned on the grate. The Genera Electric Co. had recently been placed in a position to acquire th sole rights of a process for the recovery of fuel oil and spirit fro coal, and he was joining the G.E.C. in connection with this process. Their policy in the past had been to train up their own me until they were capable of taking up important positions. Owin to the war, however, they had to resort to dilution, and, as result, he was joining the company.

Alderman Beaumont, chairman of the Electricity Committe said the St. Marylebone undertaking would feel greatly the loss o its chief engineer and manager, who had done so much good wor for it in the past; however, the situation could not be helped, an no doubt the undertaking would be able to continue in the futur as it had done in the past. He briefly referred to the difficulti under which the undertaking had been labouring, and said ther was a movement on foot for the co-operation of the electric departments in the whole of the metropolitan area which woul no doubt, result in better conditions for all concerned. Councillo G. B. Brooks also spoke, and Mr. Wilson presented to Mr. Se brook a handsome silver salver, suitably inscribed, which wa subscribed for by the Council. The Mayor, Alderman Dunca Watson, and Councillor Rickatson contributed to the musical pa of the programme, which was greatly appreciated.

A BRITISH ELECTRICAL PROVING HOUSE.

By C. TURNBULL, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

This paper, for the title of which the author is indebted to Mr. C. H. Wordingham, President of the Institution, deals with a proposal to provide a proving house to meet the requirements of the British electrical industry, for the purpose of testing electrical accessories, wiring materials, &c., although its work would doubtless extend to other directions as the necessity arose. One may compare its operation with that of Lloyd's Register, which has done such remarkable work for the shipping industry. Local laboratories have been in existence in Manchester and Glasgow, and possibly other towns, for many years past, and their work has been beneficial to the districts concerned. Establishments on a larger scale are also at work in some other countries with good results.

In this country the Engineering Standards Committee has produced a number of excellent specifications which have prepared the way for work of a more advanced nature. One may also mention the very useful work done by the Cable Makers' Association. Before the introduction of the C.M.A. cable specifications it was customary for every consultant to specify for cables based on his own experience, with the result that there was an unnecessary diversity in the types passing through the factories. The C.M.A. specifications were immediately accepted by the industry, and their use has caused a great saving to both buyers and manufacturers. The Institution Wiring Rules have resulted in a further simplification in wiring work, as practically all authorities throughout the land now accept them as their standard. In these cases the work has gone no further than the issuing of specifications and rules, and no laboratory has been established for testing apparatus and material to see if the same conforms to requirements.

It is not enough merely to print rules relating to installation work; no matter how much care may be taken in their wording, from time to time it will happen that doubt will arise as to their meaning. A difficulty also arises in specifying materials for installations. It is common practice for consultants to specify the actual makers of the apparatus and materials to be used, and from many points of view the plan has merit. But the plan has its disadvantages. Prices may be increased where suppliers know that their goods are specified, while less-known firms may have difficulty in getting their things on the market.

The best solution of the difficulty would be for the electrical industry to found and maintain a proving house to test samples of standard apparatus and materials, and to give certificates where the same had passed the tests imposed. Consultants would merely specify the class to which the materials should conform, and it would no longer be necessary to mention the manufacturer's names. The use of various classes would result in economy in many instances; it might eventually be found that much cheaper material would be satisfactory for the ordinary installation than are now considered desirable. We have had an example of this in the case of the higher densities now allowed for small sizes of rubber-covered wires, the increased carrying capacities having been discovered as soon as scientific methods were brought to bear on the problem.

The proving house would enable contractors to buy their materials on the best terms, with the certainty that there would be no difficulty in getting them accepted by buyers. Manufacturers would also be able to guarantee their goods, as they would know exactly what tests would be enforced. Buyers would soon demand that only certified goods must be supplied to them in all cases; this would tend to eliminate unsatisfactory apparatus and materials of every kind.

It is suggested that the proving house should be organised on commercial lines, its aim being to assist British trade. Its certificates would give a hall-mark to those British firms who were able to satisfy its requirements, and this would create a prestige for British manufacturers which would be useful not only at home, but in foreign markets. The value of such prestige is incalculable; an enormous amount of business comes from foreign markets to firms who have been able to create the feeling that their goods are the real thing, and once this feeling has been created it is difficult for competitors to get in at all.

The board of control might consist of representatives drawn from all interests concerned, including Government departments, consulting engineers, manufacturers, electric supply undertakings, insurance companies, and users of electrical goods. The laboratory work would be carried out by a highly trained staff provided with the necessary equipment. The control committee would keep the proving house in touch with modern ideas, and see that it did not get out of date.

The duties of the proving house might be on the following lines:—

1. It would assist the Engineering Standards Committee in the preparation of specifications for electrical accessories and apparatus, with details of tests which they were to undergo.
2. In conjunction with the appropriate committee, it would assist in drawing up new and improved rules from time to time.
3. It would test samples from manufacturers, and certify those which were satisfactory.
4. It would test actual samples taken from installations, and decide whether the same came up to specification or not.
5. It would keep in touch with breakdowns and failure of materials and accessories, with a view to the elimination of those which were defective.
6. It would publish results obtained in a form useful to the manufacturer and user of electrical apparatus.

It is suggested that the proving house should begin its work by taking up the testing of selected electrical accessories, such as rubber-covered cables as used for ordinary installations, switches, fuses, plugs, starters, and similar things, other items being added as found desirable.

The testing of rubber-covered cables is admittedly a difficult subject, but, from past experience, we may be certain that efficient methods will be discovered when expert investigators tackle the problem with the aid of a properly equipped laboratory. It is impossible to frame rules which debar inferior cables, unless recognised tests are introduced by which the bad may be discriminated. Before the war very large quantities of cheap German cable were introduced into this country, and much of this was known to have a short life. Some of the flexible wire now sold is of unsatisfactory quality, and means should be taken to remove it from the market.

From time to time makers introduce new types of cable, some of which are of great value, while others are not. The question arises: How can wiring rules committees deal with such new types? Take, for instance, cables protected with tough rubber compound. These are permitted, without casing or conduit, by Clause 65 of the Institution Wiring Rules subject to their conforming to certain conditions, yet it would doubtless be possible to make a cable, of which a new sample would fill all requirements of the Wiring Rules, although such cable might not be reliable over a long period of time.

The tests undertaken by the proving house would ultimately ensure that only suitable materials came on to the market.

Many inferior lampholders have been imported into this country, and have had a ready sale owing to their low prices. The ordinary cord-grip fitted to lampholders cannot be depended on for gripping the flexible cable, but even when it does so, it nips the cable in such a way that the latter is liable to break off just above the grip. Lampholders are often not made to gauge, so that they do not fit lamp tops properly. The proving house could do useful work in eliminating poor designs and patterns of holders.

Many details in the manufacture of lamps have given trouble, although, on the whole, British lamps are satisfactory. Caps sometimes come loose owing to defective cement, and the leading-in wires occasionally short-circuit. Half-watt lamps taking 150 and 200 watts have Edison screw caps, while lamps of 300 watts and over have Goliath caps. At 220 volts the current of the 150-watt lamps is about ¾ ampere, and for the 200-watt lamp it is still under an ampere. Lamps at these currents have run satisfactorily from ordinary bayonet-cap lampholders for many years past, and it seems to be an unnecessary inconvenience to make them with the Edison cap now.

Much useful work could be done by the proving house in getting information as to the economical life of metal lamps. In this country they are usually much underrun, whereas on some parts of the Continent the lamps are overrun. It is probable that it would pay users here to run their lamps at a higher efficiency.

The use of efficient reflectors, instead of dense shades, has made a marked improvement in illumination during recent years. Yet the old vicious type of shade is still used far more than it ought to be. The proving house could assist in the direction of reform.

Many tumbler switches listed for 5 and 10 amperes at 240 volts are unable to deal with anything like the full load. Many double-pole switches in cast-iron cases are quite unsuitable for breaking their rated loads frequently, particularly if the circuit be at all inductive. The general design is often defective. Switches for electric ovens, radiators, &c., are often unsatisfactory, as their capacity for breaking current is insufficient. There is an opening in this direction for much useful work, so that defective designs might be superseded.

There is much need of experimental work to determine which types of insulation are reliable. Slate is still used for switchboards, but it is liable to faulty insulation. Many of the artificial insulators are also defective. Insulation for radiators and ovens particularly requires investigation, both as to the actual properties of the materials and as to the design. The whole subject of insulation would give profitable employment to a large department of the proving house.

Many of the fuses in use are far from satisfactory. A favourite design for house distribution-boxes has the fuse on the top of the bridge. This exposes an unwary operator to the danger of severe burns should the fuse blow when it is being replaced. Fuses should be arranged so that they will be reasonably safe if they are inserted on a short-circuit. Many fuse bridges are weak, and are liable to fracture every time a fuse blows on a heavy overload. Clips also often break off after they have been in use for some years. One may ask here why makers still maintain the habit of supplying distribution boards with glass fronts. A wooden door would be far better.

Certain types of enclosed fuses for a time had a great sale, but experience did not bear out the claims of certain patterns. A proving house would be very useful in preventing such unsuitable apparatus from getting into general use.

The proving house could do useful work in ensuring that plugs conformed to the design of the Engineering Standards Committee. The present needless diversity in designs is a perpetual source of irritation.

The question will be asked: How is the cost of the proving house to be met? Our Allies in the United States pay the expenses out of the profits which accrue from research work, and have something over besides. There should be no difficulty in arranging a levy on an equitable basis, while in addition there would be a revenue from fees for testing apparatus. The U.S.A. laboratories obtain hundreds of thousands per annum for research work, and one may expect that British firms would be no less enterprising, once they had come to understand the benefits of the work.

It is evident that some legislation is required to put the wiring and accessories business in a proper position. For instance, it ought to be an indictable offence for anyone to fix a heavy shade in the roof of a public building, suspended on a weak lampholder by a piece of thin, inferior flexible cable, with no proper means of taking the weight. It ought also to be an offence for anyone to wire houses with cable the insulation of which may be expected to perish in a short time. But it is evident that Parliament cannot pass the legislation required until a recognised authority is constituted which can be relied upon to give correct verdicts on matters submitted to it. Lloyd's Register, for instance, receives recognition by the authorities because it has proved itself capable, and the British Electrical Proving House would also receive similar recognition when it had become the accepted authority of the industry.

Mr. A. P. M. Fleming's book on "Industrial Research in U.S.A." shows that many private firms in U.S.A. spend as much as £100,000 per annum in research work, and their enthusiasm for it is continually growing. England's neglect of science has become almost a proverb, with results which the war has brought out very clearly. During the present century we have not utilised the engineering ability of our people to the fullest extent. The establishment of the proving house would introduce a new era in many directions. When its experts declared that apparatus was not fulfilling its functions properly, the manufacturer would not be slow to make the required changes. The proving house would further provide scope for the trained experimenter, and act as a training centre from which manufacturers would be able to get a supply of trained men to carry on private work. The extension of private laboratories in our works is greatly needed. Once they are able to obtain trained men, we may be sure that manufacturers will not be slow to avail themselves of the opportunity for extending the scope of their operations in the coming world struggle for industrial supremacy.

THE CONTROL OF LARGE AMOUNTS OF POWER.

Discussion at Glasgow.

Mr. E. B. Wedmore read his paper on April 9th before the Scottish Local Section of the Institution of Electrical Engineers.

Mr. J. K. Stothert suggested the adoption of more than one power station in certain large districts, and said he was glad the author agreed as to the advisability of placing the reactance in the generator itself, rather than have it externally. An interesting statement was made by Mr. Wedmore about the minimising of a fault due to a cracked insulator if the insulator was mounted in brick or stone with the supporting walls reinforced. The author said that the first indication of a fault to earth was the occurrence of a dead short circuit to earth. This was not in accordance with the speaker's experience. He had one fault in view where the cable was switched out of circuit before the lead on the earth side was damaged on a 600-volt circuit. As to the rupturing capacity of oil switches, Mr. Lackie considered that there was justification in asking for much stronger tanks to contain the oil surrounding the switches. There had been numerous instances of the tanks bursting as a result of shock when the switch was opened on considerable overload. The rupturing capacity of a switch was rather a vague term. It was stated that there were on the market to-day switches capable of rupturing 750,000 kw. In connection with Mr. Wedmore's recommendation that oil switches be used for all normal switches, and the air-break switches only used for isolating parts already made dead by oil switches, there was switchgear on the market which did without the necessity of isolating switches. He referred to the "carriage" type of switch, of which Messrs. Reyrolle were the pioneers, and for the Dalmarnock works he had adopted an oil-immersed isolating switch. His endeavour there was to enclose the conductors throughout their entire length from machine to consumer in insulating material protected by lead or iron, and the bus-bars would be run up solid. The recent addition to isolating switches, viz., the locking-in device, was not quite necessary, and the earthing of the neutral point of a three-phase generator through a thick resistance was becoming very cumbersome and costly.

Mr. Norman C. Bridge expressed the opinion that in future developments, generally speaking, the model station would have to deal with one or both of two distinct sets of conditions. One type of station would deal with large demands concentrated within a limited radius, and would distribute at the generator voltage, say, 6,000 or 10,000 volts. The distribution system would be consolidated by interlinking the feeders, so that if the bus-bars were sectionalised through reactances the feeders would also require reactance. The other type of station would deal with a number of more remote centres of demand, and would distribute to these at 20,000 or 30,000 volts. The only interlinking in this case would be at the far end of each set of transmission lines through reactance between sections of the sub-station bus bars. When dealing with outputs in the nature of 100,000 k.v.a., it might be advantageous in some cases to erect a distributing and a transmitting station on a single site with eight similar generators, but with two switch houses. These would be paralleled through transformers to get interchange of power within reasonable limits. Should the whole output of the double station be required at a common voltage, the two switch houses would be paralleled through reactances. If developments could be guided on these general lines and a moderate short-circuit factor agreed upon, then the problems of proportioning impedance seemed to be fairly simple. With two bus-bar sections only in any one switch house no question arose as to the relative merits of star and ring arrangements of bus-bar reactance, and when it came to two coupled switch houses *a closed ring was obtainable without utilising the auxiliary bars.* This eliminated the principal objection to the usual ring arrangement. He suggested that the oil switch in series with bus-bar reactance was unnecessary unless the isolation of the section was a frequent requirement. With an isolator on each side of the reactance it could be withdrawn or inserted at any time when the short-circuiting oil switch was closed. As to phase faults, there were two weak points in most of the existing systems—cable joints and sub-station switches. If cable joints were made with an earthed shield between phases, and if all single-tank, three-pole oil switches working at the main voltage were replaced by single-pole switches with barriers, as in the power station, the chances of phase faults outside the station should be considerably reduced.

Mr. R. B. Mitchell said that in a number of supply stations at present, especially when new stations were being built, higher voltages—20,000 or 30,000—were being adopted to feed the existing lower-voltage system through step-down transformers. The question arose whether the two voltages should be perpetuated or whether preparation should be made for gradual elimination of the lower-voltage supply. The double transformation was admittedly a disadvantage, and for the sake of simplicity it might be well to adopt only the higher voltage throughout. Also, the cheapening of the outfit required for the smaller consumers might be brought about by the introduction of a satisfactory 20,000- or 30,000-volt fuse, which might be installed in these cases at a very much smaller cost than was necessary at present.

Mr. F. H. Whysall said that on feeders where consumers possessed switchgear which could not readily be altered or replaced, and which, owing to changed conditions, might be subjected to serious strain, it would be advisable to put in reactances.

Mr. MacLeod considered that two spares of the larger-sized units were not justified. He did not see why on machines stepping up to 20,000- or 30,000 volts the switch should not be carried on the low-pressure side. He agreed as to overhead transmission for smaller amounts of power, but not for super-stations, owing to the liability of tampering.

Mr. Hird agreed with the author's views in favour of the use of reactance.

Mr. J. R. Cowie held that the combination of switchgear with reactance was necessary, though some of the author's suggestions seemed to advocate reactance as a means of employing altogether inadequate switchgear. A new line of business was being started in the adoption of super-power stations, and Continental and American practice and information was at one's disposal. The disturbances on these systems due to switches and reactances failing under short-circuit conditions were well known, and generally resulted in rebuilding the switch and reactances. Switch failures, such as these, would not be tolerated by consumers and British engineers in this country.

Mr. E. B. Wedmore said he would reply fully through the *Journal.*

Standardisation of Motor Shafts.—Particulars are given in the *Revue Générale de l'Electricité* of April 13th of the standards adopted by French manufacturers of electric motors for the ends of the spindles—a matter of great importance in view of the extended use of electric power. Two standard types are specified, one cylindrical the other taper, with a nut and washer, a sunk key being provided in each case. The shaft diameters listed range from 10 to 200 mm. in 27 sizes.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

ANNUAL MEETING.

The annual general meeting of this Institution was held at the offices of the British Electrical and Allied Manufacturers' Association, King's House, London, on Monday, April 29th. Mr. C. E. Hunter was in the chair. After the report of the Committee for the year 1917 had been read, the chairman (Mr. C. E. Hunter) moved the adoption of the report and accounts. He said that the meeting was held at the B.E.A.M.A. offices, as it was desirable while the offices of the I.E.E. were not available to hold the annual meetings under the auspices of different electrical trade associations. The total contributions for 1917 were £782, compared with £609 in in 1916. Although an improvement, the amount was very small, chiefly because the annual festival had not been held. He was prepared, if it was the wish of the meeting, to make a chairman's appeal this year. The subscriptions were £251, compared with £270, the fall being due chiefly to many of the members being on Active Service. The total dividends amounted to £383, as compared with £327. The total cost of working the Institution was £159, as compared with £184. For the second year in succession it had been reduced, but it was doubtful whether it could be brought below the present figure. As the first object of the Institution was to build up a fund out of the dividends on which pensions could be paid to the members, the fact that £995 had been carried to the credit of the balance sheet must be viewed as a very satisfactory result. The secondary object of the Institution was to give temporary relief to qualified destitute persons. The present condition of the labour market was such that only in one case during the last year had it been necessary to give financial assistance, and in this case the total was £10. They continued to carry out the policy that to find work was a better means of helping than to give financial aid; every qualified person who applied for assistance had received it. In 1916 the Institution had a holding in 4½ per cent. War Stock and also in 5 per cent. Exchequer Bonds. This holding was converted into 5 per cent. War Stock and a further £947 had been invested in 5 per cent. War Stock, bringing the total holding in this security to £2,000, the total cost of which holding was £1,879. The total amount invested at cost price was £9,606. Mr. Campbell Swinton, the chairman of the last annual general meeting, gave a donation of £100, in the hope that by setting this example the invested funds would reach the figure of £10,000 in 1917. The Committee regretted that this stepping-stone had not been reached. Mr. Hunter was willing to follow that example, and would give a hundred guineas to the Institution, in the hope that his example might be followed by others, and thus bring the invested funds not to £10,000 but to £20,000. The Committee were extremely desirous of increasing the number of persons collecting, and asked for every possible publicity to be given to this matter, in order that the heads and the members of the staffs of firms should appoint collectors. Considerable energy had been constantly shown in Cardiff by Mr. Hobbs in supporting the Institution and obtaining new members, and a concert, organised by him in the early part of this year, had produced most satisfactory results. This good example had been followed in the Bristol area, and there the energy of Mr. Fifield was sure to produce good results in the future.

In seconding the resolution Mr. Rawlings expressed himself entirely in agreement with the suggestion made by the chairman, that an appeal should be sent out by Mr. Hunter this year. He raised the point that what seemed to be lacking in the Institution was its ability to reach the rank and file, and he hoped that from Mr. Hunter's fertile brain there would issue some suggestion that would enable the Institution to do so. They must be made to feel that they were joining an Association of which they were actual members, and not merely subscribers to a fund to help their "poor relations."

Mr. Percy Rosling, in supporting the motion, approved of Mr. Rawlings's suggestion respecting the rank and file.

Mr. Law mentioned that the Electrical Power Engineers' Association were now taking a very active interest in the Institution.

The report and accounts were unanimously adopted.

The following were re-elected members of the Committee of Management:—H. H. Berry, H. Bevis, E. J. Clarke, Lord Vaux of Harrowden, R. J. Wallis Jones, and S. D. White.

Messrs. F. W. Fifield, W. E. Hobbs, and G. C. Law were elected members of the Committee, the secretary pointing out that the presence of Mr. Fifield and Mr. Hobbs on the Committee would largely influence the successful working of the new Local Advisory Committees which the Committee had decided to form in Bristol and Cardiff. Mr. Law represented the Electrical Power Engineers' Association.

A vote of thanks to the B.E.A.M.A. for the use of its offices was passed, as was also one to Mr. Hunter, the chairman (on the motion of Mr. Justus Eck).

The chairman, in acknowledging, expressed the hope that the Local Advisory Committees would do much to bring in the rank and file.

Patent Application.—Dr. J. A. Fleming and Marconi's Wireless Telegraph Co., Ltd., are petitioning for an extension of term in respect of Patent No. 24,850 of 1904, granted to the former

THE ELECTRIC PROPULSION OF SHIPS.*

In the course of a paper by Eskil Berg read at a joint meeting of the Electrical Section of the Franklin Institute and the Philadelphia Section, American Institute of Electrical Engineers, a description is given of the new U.S. battleship *New Mexico*, which is now under construction at the New York Navy Yard. This installation provides conditions where the advantages of electric propulsion can be realised. The *New Mexico* is the largest and most powerful battleship which has been laid down by the U.S. Navy up to the present time. She will have a displacement of 32,000 tons, and a designed speed of 21 knots, requiring about 28,000 H.P. The propelling machinery is, however, designed to deliver a maximum of 37,000 H.P., and it is believed that this will give her a speed of 22 knots.

The equipment will consist of two turbo-generating units, four propelling motors (one for each shaft), switching apparatus, cables, instruments, &c. The contract also calls for two 300-KW., non-condensing, direct-current turbo-generators, which will furnish excitation and power to drive the auxiliary machinery. As the General Electric Co. was required to guarantee the steam consumption of the propelling machinery, including the auxiliaries, the greatest care was taken in their selection, and they are all to be electrically driven. The exhaust steam from the direct-current generating sets which operate non-condensing will be used for heating the feed water, and any that may not be required for this purpose will be exhausted into the main turbine. The generators for the *New Mexico* are bi-polar alternators, and the motors are arranged to be connected for either 24 or 36 poles. For economic cruising at a speed of 15 knots or less, only one generating unit will be required with the motors on the 36-pole connection. For higher speeds the 24-pole motor connection will be used with both generators. One generator, however, will be capable of driving the ship up to a speed of about 19 knots.

Speed variations with either motor connection will be obtained by varying the generator speed, and a governor will be installed similar to that used with the *Jupiter* † equipment.

The steam consumption guarantees as made to the Government cover the total amount of steam used both by the main generating units and the auxiliaries, and are as follows :—

Steam Pressure 250 lb. Gauge at Throttle.

10 knots	14·6	lb.	per shaft	H.P.-hour.
15 knots	11·4	,,	,,	,,
19 knots	11·1	,,	,,	,,
Max. speed	11·9	,,	,,	,,

Very heavy penalties are attached to these guarantees in case they are not met, namely, $25,000 per lb. for the two lower speeds, and $20,000 per lb. for the two higher speeds.

At full speed the *New Mexico's* propellers will operate at 175 revs. per minute, the lowest speed permissible within the space allowed. The propeller speed for the sister ship of the *New Mexico* with geared turbines is 240 revs. per minute, which, according to Capt. Dyson, would indicate a propeller efficiency 9 per cent. worse than is expected on the *New Mexico*, and this difference would more than compensate for the electrical losses in the motors and generators.

In order to be able correctly to judge the relative economy of different methods of propulsion, it may be interesting to compare the water rate per effective H.P., taking for examples of such different methods the battleships *Florida* and *Utah*, which are equipped with geared turbines; the *Delaware*, which has reciprocating engines, and the *New Mexico*, with electric drive :

	Propeller speed.	Water rate per effective H.P. per hour.		
		12 knots.	19 knots.	21 knots.
Florida	328	31·8	24·0	23·0
Utah	323	28·7	20·3	21·0
Delaware	122	22·0	18·7	21·0
New Mexico	175	17·3	15·0	16·4

The guaranteed weight of the propelling machinery for the *New Mexico* without the auxiliaries is 530 tons, with a penalty of $500 per ton for any excess over this amount. The estimated weight of the geared turbine equipment for this vessel was 653 tons.

The contract price for the *New Mexico* machinery was $431,000, and the Navy Yard estimates show that a saving of $200,000 will be effected by using this equipment instead of the equipment originally contemplated.

BRITISH MANUFACTURERS IN AUSTRALIA.

The annual meeting of the Australian Association of British Manufacturers and their representatives was held at Melbourne on February 21st. Mr. Matthew C. Coates, the president, said that the membership had increased during the past 12 months by leaps and bounds—namely, by 148 to 478. He urged members to approach their principals with a view to getting them to join the Association.

In reviewing the work undertaken during the year, he referred to the question of London representation, Federal income-tax, assessment of duty on home consumption value, Customs decisions, certificate as to home consumption value, insurance, trade after the war, &c., dealt with in the annual report. Mr. G. T. Milne, H.M.

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* *Journal* of the Franklin Institute, Vol. 185, No. 3.

† See Electrical Review, Vol. 71, October 18th, and September 20th, 1912.

Trade Commissioner, was a guest at the meeting, and the president mentioned that the relations of the Association with him had been on the most cordial terms. As he was shortly leaving to take up important work in Canada, it was the intention of the Council to arrange a farewell gathering in his honour.

Mr. Coates quoted the following figures of imports into Australia during the years 1912-13 and 1916-17 as an indication of the direction in which business was flowing :—

	1912-13.	1916-17.
United Kingdom ...	£47,600,000	£40,000,000
United States... ...	9,500,000	15,000,000
Japan	900,000	3,400,000

These figures had to be considered, of course, in their relation to enhanced prices, and, therefore, the true position in regard to the drop in the volume of imports from the United Kingdom was even greater than that shown above, as the 1916-17 figures included the increased cost of production, due to the war.

American and Japanese figures did not carry nearly the same percentage of increase. Certain industries in Australia were suffering from lack of raw material, the export of which had been restricted by the Imperial Authorities, owing to the pre-occupation of British manufacturers in war activities ; but certain manufacturers had at times had material ready in their works for shipment, but were unable to ship owing to having no priority certificates or shipping permits. It was understood that the British Ministry of Munitions had established a system of issuing rationed permits for certain material to manufacturers, and the purchase of goods manufactured from such rationed material could now be made without priority certificates. This rationing scheme would in some measure help them to regain business in Australia, which had of late been going elsewhere.

The British Ministry of Munitions had also established Advisory Committees to work in conjunction with the Department, and it was felt that the adoption of a similar procedure in connection with the office of the Australian Directorate of Munitions would generally have a beneficial effect upon trade. Mr. Coates referred to the activities now taking place in Great Britain towards the expansion of trade, and the methods to be adopted to afford greater facilities to British manufacturers and producers. All these happenings were indications that in Great Britain, and in every Dominion and Colony there were signs of alertness and firmer determination to organise trade and to co-operate through industrial associations, in order to maintain and increase the prestige of British trade after the war. Great activities had taken place with the object of placing British industries foremost in the world's markets, and establishing them throughout the Empire, and this Association would have a large part to play in these activities, as the ambassadors of commerce representing those British industries, and to consider the best means of linking up with the movements. They had already taken the first step in the appointment of Mr. Summers (late of the Commercial Intelligence Branch of the British Board of Trade) as their London representative.

Pending the advent of peace, they must meet and discuss the problem of trade after the war in all its bearings, and, if possible, be prepared to face the future. The conditions of the nation's life, and of industry, were constantly changing, and they were faced with problems arising, some slowly and some abruptly, for which there was no precedent, problems which, in any case, could not fail to be charged with momentous issues for their industry, and, perhaps, for their Association.

They must work to protect the interests of their principals who, through their efforts to win the war, were unable at the present moment to cater fully for the Australian market, and, where possible, they must urge for that measure of consideration and preference for the products of the Mother Country, to which she was entitled.

Mr. G. T. Milne, H.M. Trade Commissioner, said that there never was a time when close co-operation between the factors of production and distribution was more necessary than now, both in Great Britain and in Australia.

Mr. T. W. Heath, representing the Sydney Council of the Association, voiced a complaint that many business men in Australia were sending registered designs of British goods to Japan, where they were being copied, and placed on the Australian market in competition with the products of British manufacturers.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

6,748. "Instrument for tapping into field telegraph, &c., cables." A. MacArtair. April 22nd.

6,750. "Portable electric lamps." H. Rottenburg. April 22nd.

6,761. "Electric motors." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 22nd.

6,762. "Electromagnetic switches." British Thomson-Houston Co. and H. C. Hastings. April 22nd.

6,767. "Electric lampholders and cord grips." C. G. Bennett & H. Garde. April 22nd.

6,781. "Electric switchgear." H. W. Clothier & A. Reyrolle & Co. April 22nd.

6,785. "Electric time switches." M. A. Abrahamson, L. Christiansen and H. E. Tvermoes. April 22nd

6,795. "Current-regulating devices for dynamos running at variable speed." Officine Elettro-Meccaniche. April 22nd.

6,811. "Electric testing apparatus." J. MacFadden. April 23rd.

6,816. "Isolating faults on electrical transmissions." A. G. Collins and Crompton & Co. April 23rd.

6,817. "Protective apparatus on alternating-current system." A. G. Collins and Crompton & Co. April 23rd.

6,829. "Sparking plugs for explosion motors." J. F. Edanois. April 23rd.

6,840. "Circuit interrupters for electric ignition of internal-combustion engines." E. Marelli & Co. April 23rd. (Italy, April 27th, 1917.)

6,856. "High-tension transformers." F. Dessauer. April 23rd.

6,896. "Ferraris relay for protection of multiphase motors, &c." R. J. Jensen. April 24th. (Denmark, April 24th, 1917.)

6,910. "Vents for electric accumulators and batteries." Lithanode, Ltd., and H. Ramsbottom. April 24th.

6,914. "Apparatus for detecting variation in a magnetic field." D. K. Morris & J. W. Roebuck. April 24th.

6,918. "Electric starters for internal-combustion engines." A. H. Midgley and Vandervell & Co. April 24th.

6,931. "Self-starting devices for internal-combustion engines." F. L. Rapson. April 24th.

6,932. "Terminals for magneto-electric machines, &c." A. M. Allen and R. B. North. April 24th.

6,978. "Telephonic systems." E. A. Graham & W. J. Rickets. April 25th.

6,981. "Electric starter for internal-combustion engines." Officine Elettro-Meccaniche & G. Questa. April 25th.

6,988. "Electric lamp fixtures." S. W. Farber. April 25th.

6,991. "Apparatus for eliminating interference in wireless telegraphy." Marconi's Wireless Telegraph Co. & H. Richmond. April 25th.

7,006. "Coin-freed telephone call-boxes." Ges. fur Elektrische Industrie. April 25th. (Austria, May 25th, 1914.)

7,008. "Electric ignition devices for internal-combustion engines." W. O. Kennington. April 25th.

7,011. "Coin-freed telephone call-boxes." Ges. fur Elektrische Industrie. April 25th. (Austria, March 19th, 1917.)

7,022. "Apparatus for magnetic galvanic treatment of the human body." J. Krauer. April 26th.

7,037. "Apparatus for reproducing in ordinary characters messages received as electric impulses or as perforations in tape." F. G. Creed, Creed and Co., & A. J. Polley. April 26th.

7,047. "Electric induction apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 26th.

7,052. "Variable electric resistance." Sir W. G. Armstrong, Whitworth and Co., W. E. Dalby and J. S. Wilson. April 26th.

7,074. "Electro-deposition of iron." Brazil, Straker & Co. and F. A. Shepherd. April 26th.

7,083. "Audion or lamp relay or amplifying apparatus." M. Latour. April 26th. (April 30th, 1917.)

7,092. "Thermo-electrically-controlled valves." G. Wilkinson. April 27th.

7,129. "Portable electric batteries." Accumulators, Ltd., & A. Hunter. April 27th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,975. Electric Cooking Stoves. F. P. Fletcher. May 7th, 1917. (114,437.)

16,800. Ohmmeter. B. P. Romain. November 23rd, 1916. (114,438.)

16,801. Electric Capacity Meter. B. P. Romain. November 23rd, 1916. (114,439.)

1917.

153. Electromagnetic Switches. Electric & Ordnance Accessories Co., Ltd. January 3rd, 1917. (114,445.)

2,865. Electric Water-heater. E. C. Webster. February 27th, 1917. (114,448.)

3,061. Lifting Magnets. A. H. Curtis & Igranic Electric Co. March 1st, 1917. (114,451.)

3,253. Electric Heating Elements. L. G. Caunter. September 5th, 1917. (114,452.)

4,493. Magneto of the Type Comprising a Rotating Shield. Soc. des Moteurs Salmson. May 10th, 1916. (106,475.)

4,701. Incandescent Electric Lamps. F. Harrison & J. J. Russell. March 31st, 1917. (114,464.)

4,758. Telegraph Systems. J. A. L. Dearlove, A. Davidson & N. J. Perryman. April 2nd, 1917. (114,467.)

4,886. Manufacture of Electric Storage Battery Plates and the Paste therefor. H. Wade (L. H. Flanders). April 4th, 1917. (114,475.)

4,993. Demagnetiser for Continuous or Alternating Currents. A. Hollingworth. April 10th, 1917. (114,483.)

5,196. Reversing Devices for Internal-combustion Engines provided with Electrical Ignition. A. G. Hallberg. April 12th, 1917. (114,489.)

5,220. Electric Welding. W. H. Walker. April 14th, 1916. (105,572.)

5,414. Telegraph Systems. J. A. L. Dearlove, A. Davidson & N. J. Perryman. April 17th, 1917. (114,495.)

8,937. Electrically-driven Road Vehicles. L. la Roche. June 21st, 1917. (114,537.)

9,287. Wireless Signalling Systems. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 28th, 1917. (114,539.)

9,308. Electrical Condensers for High-tension and High-frequency Currents. A. Kowalski. April 13th, 1917. (Addition to 9,111/17.) (114,540.)

9,959. Electrical Coils, and Methods of Winding same. H. Wade (Universal Winding Co.). July 10th, 1917. (114,546.)

10,213. Ventilation and Cooling of Dynamo-electric Machines. C. W. Major. July 14th, 1917. (114,549.)

12,412. Trolley Wheels or Collectors for Electricity. A. E. Alexander (Ollard Trolley Wheel Co., U.S.A.). August 29th, 1917. (114,571.)

13,399. Control System for Two Electric Motors operating a Number of Shafts. G. Paratore. October 9th, 1916. (112,008.)

13,726. Device for Overhead Electric Trolley Wires. P. Dawson, F. W. Dawdry & H. W. H. Richards. September 24th, 1917. (114,578.)

14,033. Electric Couplings. H. de la Valette. November 3rd, 1916. (110,908.)

15,883. Shade Supports for Gas Burners and Electric Lights. F. J. Gould & E. S. Stamp. October 31st, 1917. (114,586.)

16,267. Magneto-electric Machines. British Thomson-Houston Co. & A. P. Young. November 7th, 1917. (114,588.)

1918.

1,073. Electromagnetic Relays. M. B. Richter. January 18th, 1918. (114,608.)

THE

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A NATIONAL PROVING HOUSE.

THE discussion on this subject which took place at the Institution of Electrical Engineers last week was highly interesting and profitable, and should bear valuable fruit. Moreover, it was preceded by several announcements by the President which again call forth our congratulations to the Council on the maintenance of its progressive policy, and the promptitude of its action in connection with important industrial developments, which are reported in our "Notes" columns to-day.

The subject of the meeting was one with which we have identified ourselves for many years, particularly in connection with Canadian trade; before the war we repeatedly brought this matter to the notice of our readers, and endeavoured in every possible way to arouse their interest in the immense possibilities of Canada as a market for our manufacturers. One of the principal obstacles to the development of this opening for trade in electrical appliances was the firm establishment throughout the Dominion of the standards of the Underwriters' Laboratories of Chicago, and in our issue of January 3rd, 1913—to quote merely one instance—after discussing an exhaustive report by Mr. C. Hamilton Wickes to the Board of Trade on the constitution and operation of these Laboratories, we expressed emphatic agreement with his view that a similar institution should be formed on this side of the water, to act in conjunction with the Chicago organisation. By no other means could the necessary "hall-mark" be conferred upon British manufactures, to enable them to command acceptance in North America; unless they bore the authorised label they stood no chance whatever of gaining popular recognition.

Six months later we were glad to announce that a branch of the Chicago Laboratories had been formed in London, Messrs. Heap & Digby having been appointed engineers in Great Britain to the Chicago institution, and authorised to inspect and approve articles for Canada before they left the British factory—thus removing the heavy handicap involved by the necessity previously incurred of having them inspected after arrival in the Dominion. This arrangement came into operation, and was in force until the war broke out and diverted attention from the subject.

The subject of the discussion was a familiar theme to Mr. Wordingham, to whom is due the credit for having brought it forward no less than 20 years ago; again in May, 1913, he pressed the matter upon the attention of the Institution, and the Industrial Committee recommended the establishment of a national proving house; but the then Council of the I.E.E. rejected the scheme as having a "political" tendency,* and turned it down, shortly afterwards extinguishing the Committee itself. *Tempora mutantur*—and what a salutary change has come over the Council! Truly, we are making progress at last. Mr. Wordingham published his scheme in our issue of July 24th, 1914, p. 124, and we tender him our hearty congratulations on the coming fruition of his ideas, on practically the very lines which he then advocated—and now with the support of the I.E.E. Council.

By a coincidence, we had in hand at that date an article outlining a similar proposal, which we published in the following issue (Elec. Rev., July 31st, 1914, p. 193); we have pleasure in stating that the author, who then preferred anonymity, was Mr. C. Turnbull, whom we join with the President in our congratulations.

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* ELECTRICAL REVIEW, May 22nd, 1914, p. 854.

As regards the present scheme, while there is no need to discuss the details of its organisation, we are glad to note that the Director of the National Physical Laboratory, Sir Richard Glazebrook, promised his cordial co-operation, and that the Secretary of the B.E.A.M.A., Mr. D. N. Dunlop, expressed the approval of his Association. Mr. C. le Maistre, Secretary of the British Engineering Standards Committee, speaking unofficially, also heartily endorsed the proposals of the Council, and we have no doubt that they will be supported by the whole industry. All is now, therefore, plain sailing, and we hope soon to see this excellent and long-wanted institution established on a firm basis. We have referred above to its connection with Canadian trade, and there is no question that this has had a great deal to do with the matter; but the benefits to be derived from the National Proving House will be by no means confined to this particular market—they will be felt in every market, at home and abroad, to which our manufactures penetrate.

Foreign Languages and Trade.

It cannot be said that the British commercial world has done its best to encourage the study of foreign languages. Too many boys destined for clerical and such-like careers in commerce leave school with only a very slight acquaintance with other tongues besides their own. Only in special cases here and there have employers encouraged their young employés to complete this half-knowledge, or to learn other languages. We have met merchants who attached little importance to such qualifications because they could always get translation work done at such-and-such a rate at a bureau run by some foreigner or other. Then, when a member of the staff had grown up with and learned the business itself so as to be capable of going on a tour of representation abroad, he was bound to be at a disadvantage because he knew little beyond his own native language. Who has not known cases in which a foreigner has been engaged to travel abroad for a British house partly because his credentials included linguistic attainments? The best course surely is to send British men who know the business, and to encourage them in good time to learn languages likely to be of assistance in the markets that the firm intends to develop. We trust that we are getting away from our old neglectful ways to-day, in view of the approaching need for strong representation in many foreign countries where our own language is only slightly used. In the past it was so easy and so cheap to engage a German clerk for office work that an English lad with linguistic knowledge was not appreciated and paid as he should have been. We hope that we have learned the lesson well, and that we shall be on our guard in the future. The dangers attending our neglect of business languages, so obvious to many of us to-day, are emphasised by the report of the Government Committee which has inquired into the "Position of Modern Languages in the Educational System of Great Britain." Too many of our sons have been spending years learning Greek and Latin when they ought to have been otherwise occupied. We shall be extremely unwise if we allow them to carry present-day justifiable prejudices to such an extent that they neglect German. The evidence collected by the Committee testified to the fact that in the past business operations had been hampered by British ignorance of foreign languages, and heads of firms who did themselves possess such knowledge showed how valuable it had been to them in their trading relations. Those who testified that English was the leading language of commerce, and desired that we should try to make its use universal, may have stated a fact, but not one that would justify us in ignoring the conditions prevailing in South America, Russia, China, Spain, Italy, and some other important markets where Germany found her way in because her agents were equipped with a knowledge of the languages of those countries. There are tens of thousands of potential purchasers in the world who do not know half-a-dozen words of English. Are we to tell them to learn English first if they want to do business with us? If that is to be our attitude we deserve to lose in the trade competition that will confront us. Surely we know by now the uselessness of circulating abroad correspondence and catalogues limited to our own language, prices, and weights and measures. Few firms of standing in the electrical trade are likely to fall into the error of ignoring that warning in the future. The Committee concludes its report with a number of recommendations which we trust will be acted upon. It is unfortunate that the war-time shortage of paper, or, shall we say, its use for what to us are unessential purposes, should prevent the fullest possible publicity being given throughout the length and breadth of the land to these recommendations. It needs to be widely known that after an exhaustive study of the subject the Committee advises that the business community in every considerable centre of foreign trade or of manufacture for foreign markets should take steps in conjunction with the education authorities to further the formation of institutes of languages, both for full-time and for part-time study; also that business men should encourage the study of foreign languages by those members of their staffs who possess good business ability, and show capacity for such study, by inducing them to attend such institutes; also that commercial houses and industrial firms should bring to the knowledge of the school authorities the opportunities that present themselves from time to time for all those who have special aptitude for foreign languages. In conclusion, we would suggest that at the present time, when our business houses are so dependent upon junior staffs, employers, managers, and heads of departments might give these assistants fatherly counsel upon the subject, and impress upon them the necessity for fitting themselves at once for the foreign trade conditions of the next few years.

Electric Power Supply.

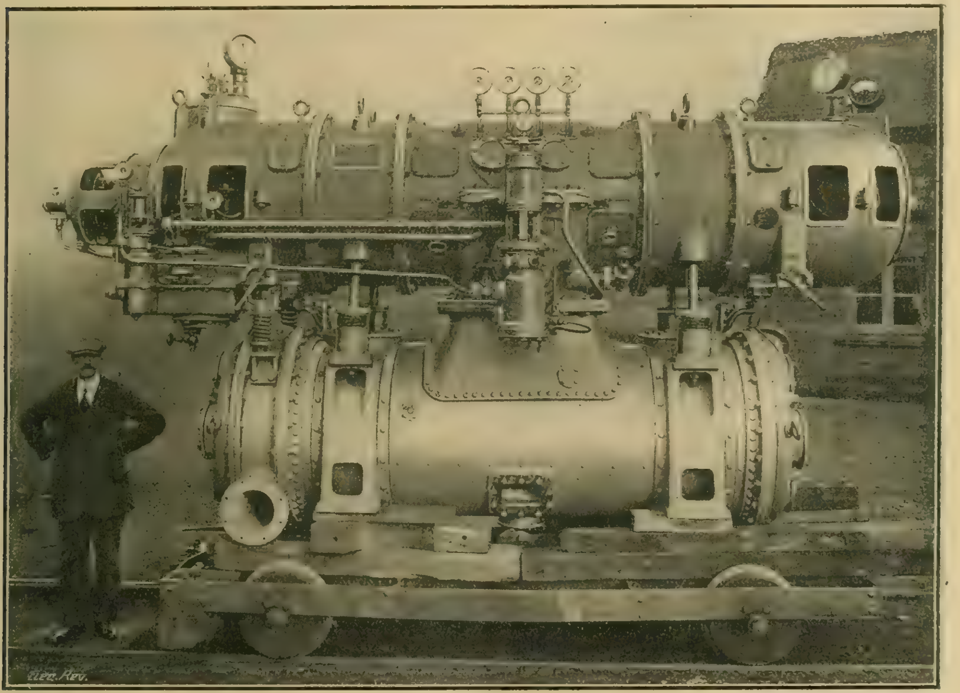
The Bill promoted by the British Aluminium Co. to enable it to obtain an increased supply of water-power for the production of aluminium was up for second reading in the House of Lords on April 30th, but, although it was supported by the Board of Trade and the Ministry of Munitions, it met with strong opposition, mainly on the ground that the generation of power from our natural resources was a question of national importance, and ought not to be dealt with piecemeal by a commercial concern for private profit. It was urged, also, that a work of such magnitude could not be completed, and ought not to be put in hand, during the war, and eventually the Bill was withdrawn.

The question of national policy was raised also in connection with the third reading of the Shropshire, Worcestershire, and Staffordshire Electric Power Bill, the debate on which was adjourned till after Whitsuntide. Evidently, therefore, the idea of reorganisation of electricity supply on a national basis is receiving very serious consideration in Parliamentary circles. We sincerely hope that the result will not be merely to delay the progress of electricity supply.

ELECTRIC SHIP PROPULSION BY THE LJUNGSTRÖM TURBINE.

As mentioned in our last issue, we recently paid a visit to the North-East Coast to inspect the machinery of the first British sea-going merchant ship propelled by electricity—the s.s. *Wulsty Castle*, of 6,000 tons, which has been built by Messrs. John Blumer & Co., of Sunderland, to the order of the Lancashire Shipping Co., Ltd. (Messrs. J. Chambers and Co., Liverpool). The installation is of exceptional interest, not only because it marks a new era in British marine engineering, but also because the prime mover is the Ljungström steam turbine, a machine of unique design and construction, highly efficient, and of light weight.

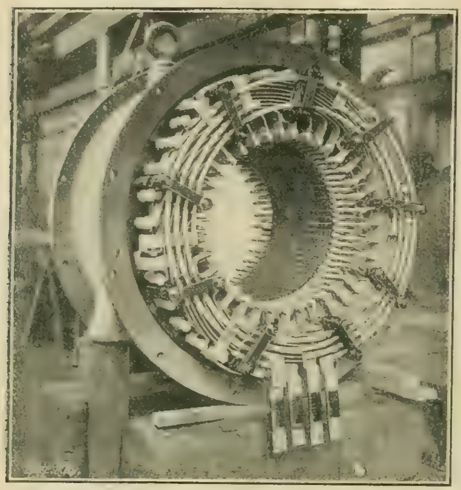
In our issue of October 10th, 1913, we gave an illustrated description of this turbine, which was developed some three years previously by Mr. B. Ljungström, a Swedish engineer, and is manufactured in this country by the Brush Electrical Engineering Co., Ltd. A more detailed description by Mr. R. S. Portham was abstracted in our issues of May 5th and 12th, 1916. The turbine is of the radial-flow type, with no fixed guide-blades, the blading being carried in concentric rings on the faces of two disks which revolve in opposite directions. These disks are mounted on short shafts, which are bolted to the ends of the rotor shafts of two three-phase alternators, and are entirely overhung, so that the two rotors can be uncoupled from the generator shafts and removed together, without disturbing the rotors of the generators. The total weight of the two rotors and blading of a 1,000-kw. set is only about 5 cwt. As the relative speed of the two sets of blading is twice the actual speed of either, and the turbine is of the reaction type, the conditions enable a very high efficiency to be attained. Steam enters at the centre, and flows out radially through the interlacing sets of blades, being discharged into an exhaust chamber which surrounds the rotors; thence it passes immediately into the condenser, upon which the turbo-generator is mounted, the turbine casing being bolted directly to the condenser inlet. As will be seen from the accompanying illustration, this is the only rigid support of the generating set, so that no provision for expansion is required; stout steel springs bear the weight of the machine at either end.



Ljungström 625-kw. Turbo-generator for the "Wulsty Castle."

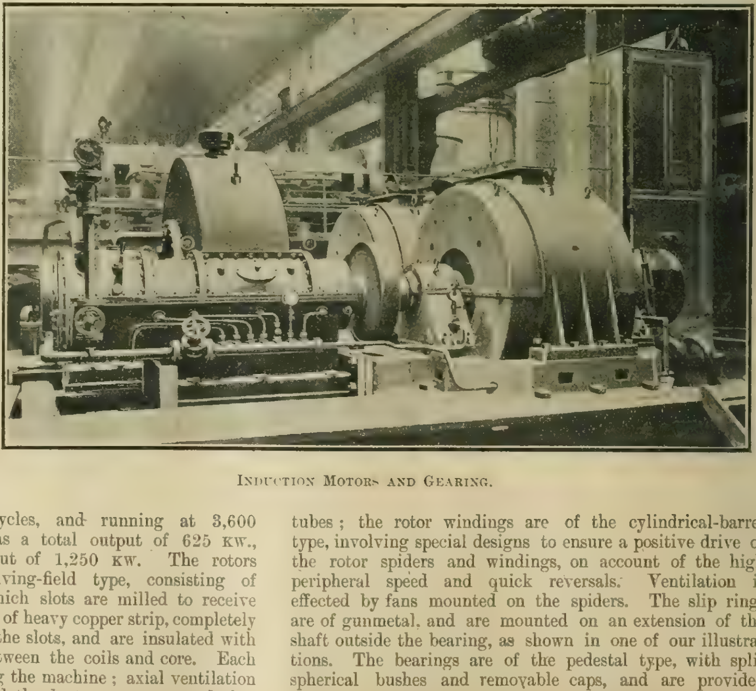
The two alternators are normally electrically coupled in parallel, automatically synchronise whilst running up to speed, and run as one machine. A single exciter is mounted on the outer end of one of the generator shafts, and excites both fields in series. The speed is controlled by a centrifugal governor actuating an oil relay, and an emergency device is provided, which cuts off the steam by releasing the oil pressure if the speed becomes excessive, or if the bearings overheat. Forced lubrication is provided by an oil-pump, which also supplies oil under pressure to control the stop-valve. Owing to the high relative speed of the two rotors, the number of rows of blades is only one-fourth of the number required in an ordinary reaction turbine; the whole of the revolving parts are mounted symmetrically on solid disks, so that there is no liability to distortion due to temperature changes, and the highest degrees of superheat can be safely employed. The turbine is exceedingly compact, the whole set being smaller than an ordinary reaction turbo-generator.

In the paper by Mr. Portham, mentioned above, which was read before the Institution of Engineers and Shipbuilders in Scotland, the author dealt very fully with the application of the Ljungström turbine to marine propulsion, and gave particulars of tests carried out on two Swedish steamships—the *Mjölner* driven by two of these turbines, and the *Mimer*, a sister ship driven by triple-expansion reciprocating engines; under the same running conditions, the fuel consumption of the former vessel in service was 38·6 per cent. less than that of the latter, and the turbine equipment showed a relative reduction in weight and space occupied of 25 per cent. Maintenance costs in 16 months' running were practically nil, and no breakdowns were recorded. Owing to the high superheat permissible and the characteristics of the turbine, the gain in thermal efficiency fully compensates for the losses due to electrical conversion; an astern turbine is unnecessary, as the motors are reversible, and the boiler plant is reduced in proportion to the steam consumption of the propelling plant.



Stator of the Ljungström Generator.

While the *Wulsty Castle* is the first British ship equipped with the Ljungström system, she will not long remain the only one; several Swedish ships have been fitted with it, and the contracts completed, or in course of execution, for installations varying from 1,000 to 6,000 s.h.p., amount to 102,000 s.h.p., no fewer than 45 British, American, and Scandinavian ships being concerned.



Induction Motors and Gearing.

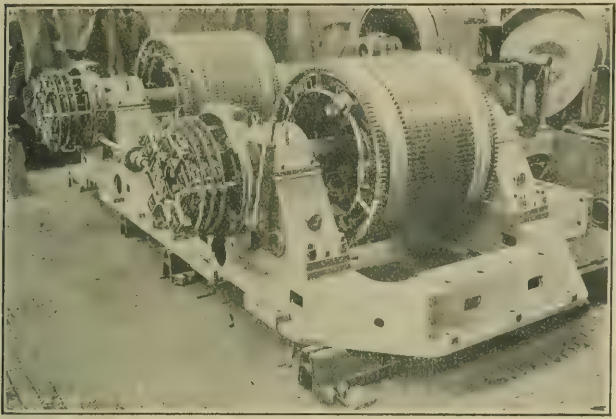
Turning to the installation on the *Wulsty Castle*, one's first impression of the engine room is one of spaciousness. The centre is occupied by the motors and gearing; at either side is a turbo-generator and condenser, and above is empty space up to the bridge deck, offering a striking contrast to the engine room of a ship driven by reciprocating engines. Each turbo-generator consists of two three-phase alternators coupled to the turbine rotors, each machine having a full-load output of 312·5 kw. at 650 volts, 60 cycles, and running at 3,600 r.p.m. Thus each set has a total output of 625 kw., giving an aggregate output of 1,250 kw. The rotors are of the bipolar revolving-field type, consisting of solid steel forgings, in which slots are milled to receive the windings; the latter are of heavy copper strip, completely formed before insertion in the slots, and are insulated with mica between turns and between the coils and core. Each rotor carries a fan for cooling the machine; axial ventilation is employed throughout, and the ducts are so arranged that they can be cleaned without stripping the machine. The heated air is carried off by trunks to the Howden preheating plant, to be further heated by the exhaust gases from the boilers, and finally fed to the furnaces, no other fans being necessary.

The stators of the generators are wound with one solid bar per slot, insulated with a seamless mica tube; the end connections are of very massive flat strip, supported by specially designed brackets. An exciter is directly coupled to each set. The machines are specified to run at full load for six hours without exceeding a temperature rise of 65° F.

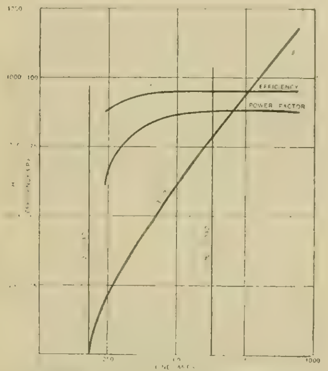
The turbines are run up with exhaust to the atmosphere, oil under pressure being provided by separate steam-driven pumps; on the attainment of a certain speed the auxiliary oil, circulating, and air pumps automatically come into operation, and the steam oil pump shuts down. The circulating pump is of the Pulsometer type, driven by an 18-b.h.p. motor; the air pump, of the Kinetic type, and the condensate pump, both made by the Pulsometer Engineering Co., Ltd., are driven by 15-b.h.p. Brush vertical-shaft motors. All the auxiliary motors are of the squirrel-cage induction type, and both sets can be supplied with current from either generating set; the motors are controlled by Berry switches, mounted on switchboards at the after end of the engine room, but in practice they are run up simultaneously with the generators. The condenser is of the Contraflo type, made by the Brush Co.

The main driving motors are of the ventilated enclosed type, with enclosed slip rings, and are mounted side by side in the middle of the engine-room; each is coupled by a heavy flexible coupling to the shaft of a pinion gearing with a large double-helical spur-wheel, made by the Power Plant Co., and completely enclosed.

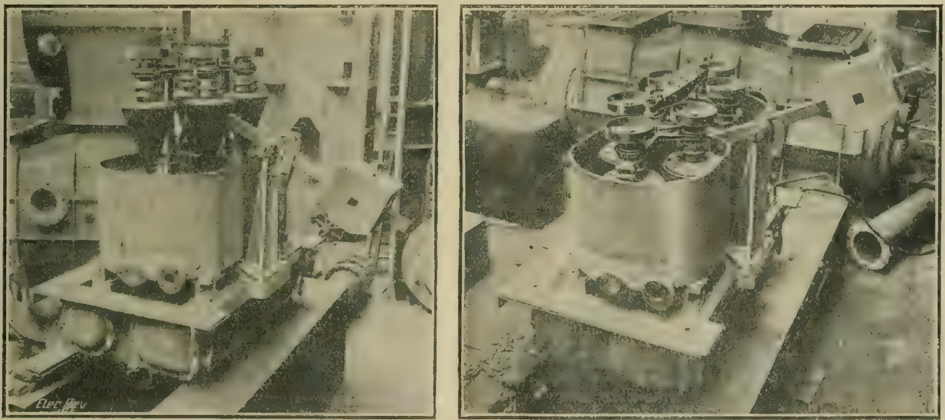
The motors are each capable of a continuous output of 785 h.p. with a temperature rise not exceeding 65° F., and have an overload capacity of 120 per cent. without stalling. They are fitted with brush-lifting and short-circuiting gear, to avoid friction loss and wear of brushes, and are designed for the highest possible efficiency, the guarantee being 94 per cent. at full load. The stators are wound with a single bar per slot, insulated with seamless mica tubes; the rotor windings are of the cylindrical-barrel type, involving special designs to ensure a positive drive of the rotor spiders and windings, on account of the high peripheral speed and quick reversals. Ventilation is effected by fans mounted on the spiders. The slip rings are of gunmetal, and are mounted on an extension of the shaft outside the bearing, as shown in one of our illustrations. The bearings are of the pedestal type, with split spherical bushes and removable caps, and are provided with forced lubrication. Each motor is carried on a bedplate extended to join up to the gear casing. The motors run at 714 R.P.M., and the propeller shaft, which is coupled to the large spur-wheel, at 76 R.P.M. The total speed ratio, generator to propeller, is therefore about 47 : 1, and the shaft H.P. is about 1,500. An oil pump is mounted on the after end of each pinion shaft, and the propeller shaft is provided with the Michell thrust-bearing.



Rotors and Brush-gear of Motors.



Efficiency and Power-Factor Curves of Motors.



Liquid Controlling Resistances in "Stop" and "Full-speed" Positions.

The manœuvring gear is wholly comprised on a panel at the forward end of the engine room, mounted on the front of a cubicle containing the controlling apparatus. The speed of the motors is regulated by inserting resistance in series with the rotors; the resistances are of the liquid type, consisting of two sets of cones of a cast-iron alloy, the lower ones being stationary and filled with potash solution, while the upper ones are carried on vertical spindles, which are raised or lowered by a hand-wheel mounted on the front of the panel, the weight of the cones being counterbalanced so that the effort required to turn the wheel is nominal. Rotating the hand-wheel from the mid position through a right angle in either direction causes the propeller to rotate in the same direction, at a speed corresponding to the angle through which the wheel is turned. In the mid position of the wheel the upper cones are lifted entirely out of the liquid, the rotor circuit is broken, and the motors are stopped. At full speed the cones are nearly in contact, and the resistances are cut out by a short-circuiting switch. The liquid is circulated through coolers by small motor-driven Pulsometer pumps, and the brush-lifting gear on the motors is mechanically interlocked with the manœuvring gear, so that the brushes cannot be raised unless the gear is in the full-speed position, nor can the gear be moved from the stop position unless the brushes are down. Reversal is effected with the hand-wheel in the stop position by one electrically-operated oil-type reversing switch, which reverses two of the phases in the stator circuits. The switch is so designed that each motor can be supplied from either generator, singly or in parallel. The rheostats regulating the excitation of the generators are geared to the main hand-wheel so as to prevent an undue variation in voltage when the hand wheel is turned; the rheostats can also be operated by hand. Oil switches with overload trips are provided in the motor stator circuits, and oil switches with overload and reverse trips in the generator circuits. The instruments mounted on the panel include one bus-bar voltmeter, two watt-hour meters in the generator circuits, two ammeters (one in each generator circuit), and two exciter voltmeters; synchronising gear for paralleling the generators is mounted on a bracket attached to the manœuvring panel. The whole of the manœuvring gear is housed in a cubicle close to the motors, as shown in our illustration; the cubicle is built of channel and angle iron framework covered with steel plates, hinged doors of perforated metal being provided at the sides to give access to the gear.

The cubicle rests on the coolers for the electrolyte, and the cables from the various machines are brought into a seating below the coolers; the connections between these cables and the gear are of solid copper rod, carried in ducts at the back of the cubicle. Most of the switches and instruments were supplied by Messrs. Switchgear & Cowans, Ltd. The wiring consists of three-core armoured cable.

A small lighting set is provided, consisting of a de Laval turbine coupled to a 20-KW. motor-generator set, comprising a three-phase motor and a D.C. compound-wound generator working at 60 volts, 1,720 R.P.M. The turbine drives the dynamo, with the motor uncoupled, when the main generators are shut down, but normally the turbine is uncoupled and the motor drives the dynamo. This set can also be used for exciting the main alternators in case of emergency.

The steering gear is electrically controlled, of the Hele-Shaw-Martineau type—a 20-B.H.P. three-phase motor actuating an hydraulic telemotor. Normally the steering engine only absorbs about 5 B.H.P., and it is extremely sensitive.

The accompanying curves show the characteristics of the motors, which on test gave an efficiency of 94·8 per cent., at full load, with a power factor of 0·875.

We are indebted to the contractors, the British Ljungström Marine Turbine Co., Ltd., for the opportunity to inspect this interesting installation, and for the illustrations here reproduced. Most of the plant was made by the Brush Electrical Engineering Co., Ltd., of Loughborough, who have also built many Ljungström turbo-generators for British power stations. The work was carried out under the supervision of Messrs. Wm. Esplen & Son, consulting engineers, of Liverpool.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Ironclad Cubicle Switchboard.

A 15,000-volt "Witton" ironclad cubicle switchboard is depicted in the accompanying illustration, fig. 1. The whole of the apparatus, including isolating links, instrument transformers, and so forth, is included in the cubicle, and very special care has been taken to give adequate clearances. The oil switch has a capacity of 200 amperes, and is constructed of steel throughout, there being one tank per phase. By means of a simple tank-lifting device, any tank can be removed to inspect the switch or replace the oil. Despite the size of the switches, the design is such that they can be easily operated by hand. The doors at the back which give access to the whole of the apparatus are interlocked with the oil switches, giving the well-known "Witton" mistake-proof characteristics. This switchboard was constructed by The General Electric Co., Ltd., of Witton, Birmingham, and 67, Queen Victoria Street, London, E.C. 4.

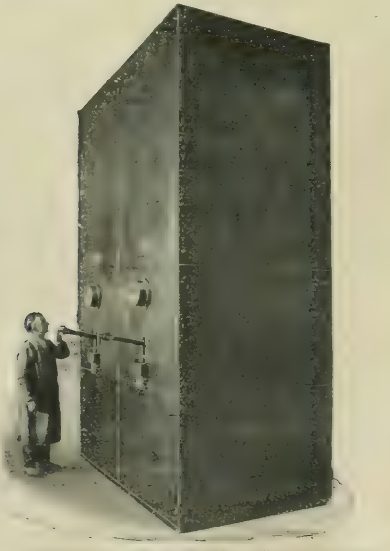


Fig. 1.—15,000-Volt Ironclad "Witton" Switchboard.

B.T.H. Induction Motors.

We have received from the British Thomson-Houston Co., Ltd., Rugby, their new illustrated descriptive list, No. 2,142B, on two and three-phase induction motors. The illustration, fig. 2, shows a slip-ring induction motor (type IX, form M) with special drip-proof covers, fitted to the openings in the frame and end shields. These covers, while allowing efficient ventilation, protect the motor from falling dirt and drippings of water such as is likely to be met with in mines.

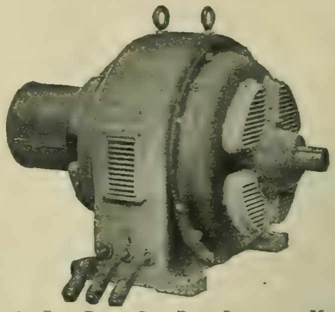


Fig. 2.—Drip-Proof Slip-Ring Induction Motor.

This type of machine is one of three different types that have been standardised, so that motors up to 450 H.P. capacity and to meet most conditions of service can be supplied. Type IX embraces all medium and large motors, both of the squirrel-cage and the slip-ring forms; it also covers the small squirrel-cage motors up to 10 H.P. Two- and three-phase motors of any of the above types can be designated by the additional letter Q or T respectively. Numbers are assigned to the frame sizes, so that the size of any machine can be specified by quoting the type symbol and frame number. Form letters K and M are used for the squirrel-cage and slip-ring motors respectively.

Automatic Control for High-Rated Electric Furnaces.

The accompanying diagram, fig. 3, shows an arrangement whereby variable voltage operation of three-phase electric furnaces can be accomplished by changing the high-voltage connection. The high melting voltage is obtained by connecting the high-voltage windings in delta and the lower refining voltage by connecting them in star. During the melting period variable voltage is obtained by means of high-voltage taps, and external reactance is provided to be cut in during this melting period. The furnace is equipped with a three-section control panel containing three shunt relays and three contactor groups. Contact-making ammeters are also provided, with dash-pots to prevent hunting of the electrode motor, and the coils are provided with taps which are used to vary the amount of power supplied to the furnace. Each contactor group consists of three units all mechanically interlocked, two contactors being normally open and the other being normally closed. The motor for operating the electrodes is dynamically braked so that all moving parts may be stopped instantaneously. The installation as described is manufactured by the General Electric Co., U.S.A.—*Electrical World.*

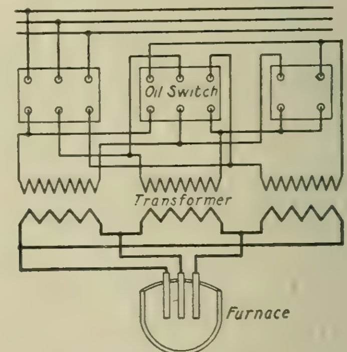


Fig. 3.—Different Heats obtained by Changing High-Voltage Connections.

Temperature Conversion Table.

We have received from the Cambridge Scientific Instrument Co., Ltd., of Cambridge, their new temperature conversion table in the form of a spiral 100 in. long, which occupies the centre of a card and shows individual degrees from absolute zero up to 2,000°, both in the Centigrade and Fahrenheit scales. On the same card there are also conversion formulæ and a number of other tables such as temperatures of saturated steam at various pressures, specific heats at normal temperatures, thermal conductivities at normal temperatures, proportions of mixtures for quenching and tempering baths, useful standardising points, &c. The tables, which are clearly printed on stiff varnished cardboard, should be found useful by many who may have occasion to use them. They can be had on application, with stamps to cover postage (6d.).

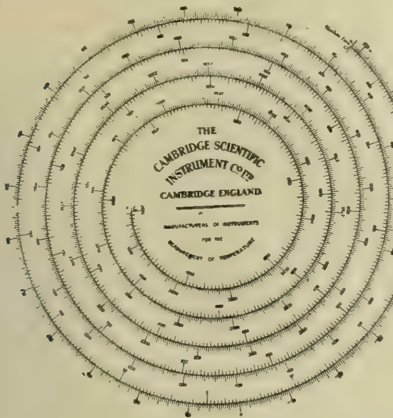


Fig. 4.—Temperature Conversion Table.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The 12½ per cent. Bonus.

With reference to your correspondent's ("Technical Clerk") letter *re* the above in your issue of May 10th, if "Technical Clerk" and other clerks in similar positions who have not received the 12½ per cent. award will kindly communicate with our General Secretary, 13, Brunswick Square, London, W.C. 1, or myself, we shall be pleased to inform them how to proceed to secure this bonus.

Ben Griffiths,

Welsh Organiser, National Union of Clerks.

47, Queen Street, Cardiff,
May 11*th*, 1918.

Report on Post-War Trade.

I entirely agree with the words contained in the leader which appears in your issue of May 3rd :—

"The hour has not yet struck for the profitable discussion of this great subject, but sooner or later it will come prominently before the nation, which, under the influence of war and war-time revelations, has developed some of its thinking."

Truly, when one reads carefully the report of the Balfour Committee on Post-War Trade Policy, and peruses side by side with this the report of the eighteenth annual general meeting of the British Westinghouse Electric and Manufacturing Co., Ltd., and then refers to the reports of the last meetings of the Metropolitan Carriage, Wagon and Finance Co., Ltd., Messrs. Vickers, Ltd., and the British Trade Corporation and the directorates of these companies, "it gives one furiously to think."

Whilst I am entirely in sympathy with the passage you quote from the report, namely, that "every encouragement should be given by the Government to the formation of combinations of manufacturers and others concerned with securing supplies and materials," we must not lose sight of the principles involved in this recommendation. The present life and death struggle between the forces of democracy and autocracy illustrates more clearly than anything else could have done that the same laws which govern the destinies of nations control those of industry and commerce. Thus in the national interest, and more especially in that of the smaller, and therefore weaker, producer, trader, and manufacturer, those of us who possess sufficient prevision to influence those in authority to avoid excesses, must employ all the energy we possess to make assurance doubly sure that no misrepresentations or misunderstandings will be permitted to prejudice constructive action based on the recommendations of the Balfour Committee. Whilst I agree with your conclusions that the Committee considers it generally undesirable that the State should attempt to provide capital for industrial purposes, and I, with you, believe that industry will find it more satisfactory to rely upon its own efforts and the efforts of private banking enterprise and the Trade Bank Corporation, than to look to the State. I venture to assert that the Board of Trade, the British Trade Corporation, and the industrial community at large will in the future have to take exceedingly broad views in these matters if the cures which they recommend for the ills from which in pre-war days we suffered are not to prove more disastrous than the diseases themselves. Human nature being what it is, I repeat what I said at the time of the formation of the British Trade Corporation, that success or failure in all these matters must in the future depend upon the three m's—management, magnanimity, and men.

Edward Berkeley.

London, E.C., *May* 8*th*, 1918.

Joints on Triple-concentric to Three-core Lead-covered Cables.

I am obliged to Mr. Williams and Mr. Balshaw for their correspondence on the above subject in the issue of May 3rd, but regret that Mr. Williams dealt so briefly with the matter in order to illustrate and describe a class of joint other than that which appeared in my article on April 26th. The fact also that Mr. Williams has been a jointer for 24 years does not in the least give me any idea as to what his completed joint would resemble ; therefore I should be glad if he would illustrate his method of jointing a three-core L.C. to a T.C. lead-covered cable, if possible by an actual photograph, and also give particulars as to the size of the cables on which this class of joint has been made.

With reference to Mr. Balshaw's letter, the method he has adopted certainly looks neat in the sketch, but here again an actual photograph would be an advantage, and convey to one a better idea. However, I am not in any way disputing the merits of this class of joint ; but, in fairness to my article, I might here mention that I omitted to state that the insulation on the T.C. cable was jute, and not paper, and after being underground for 20 years it needs very careful handling.

The method of jointing described by Mr. Balshaw is one that I have often thought of, but never yet found it practicable to work each strand of the cored cable to lie flat all round the intermediate and outer cores of the concentric cable so as to make a neat joint and also to ensure each strand being sweated down. For instance, after opening out a 3-core and binding down to the intermediate of the concentric, I cannot imagine the complete joint looking so neat as Mr. Balshaw illustrates.

It would also be interesting to know how long it takes to make a complete joint of this description previous to fixing the lead sleeve.

In conclusion, I should esteem it a favour if your correspondents could grant me the privilege of seeing an actual photograph of their completed joints, should they at any time have one in their possession.

P. Wardle.

Electricity Works, Carlisle,
May 11*th*, 1918.

Electrification Progress in Scandinavia.—In a lecture recently delivered before the Royal Institute of Engineers, Holland, A. Groothoff reviewed the present electrification situation in Sweden and Norway.

The first electrification on a large scale in Sweden was the Kiruna-Riksgränsen line with its tonnage of iron ore of more than 3,000,000 tons per year, and this within the Arctic Circle. The line is 93 miles long. Single-phase current at 80,000 volts is transmitted from Porjus to four transformer stations, of which the first is 87 miles and the last 160 miles distant from Porjus. The voltage is stepped down to 15,000, at which pressure power is supplied to the contact device. The freight locomotives weigh about 100 tons and the passenger locomotives 70 tons. A normal freight train consists of two electric locomotives and 40 ore cars of 46 tons each, the total weight being from 2,000 to 2,100 tons. Normal speed for freight is 18½ miles per hour, the maximum speed being 31 miles per hour. The maximum speed for passenger trains is 62½ miles per hour. In the first year this road transported 1,104,000 tons of ore, which is barely one-third of its normal capacity. Despite this low traffic, it showed a saving over steam operation, due partly to the high price of coal. The continuation of the road southward to Svarton, on the Baltic coast, has been decided upon, and the cost of the extension, 143 miles long, has been figured at $7,800,000. With an annual ore transportation of 3,000,000 tons, electric traction can compare favourably with steam traction when coal is $6.70 per ton. The power for the whole road is to come from Porjus. Whether or not other State railroads in Sweden will be electrified is still an open question. The problem is not an easy one, for while electrification would increase the capacity of the roads, it cannot do very much, because most Swedish railroads are single track. This limits the total traffic, regardless of motive power. In 1917, Norway had a total of 1,970 miles of railroad track, of which 44½ miles were electrified. Plans are under way for the electrification of several short lines owned by the State. A comprehensive plan for the complete electrification of all the State railways has also been worked out, involving the expenditure of $14,000,000 for the power stations alone.—*Electric Railway Journal.*

REPORT ON THE PROTECTION OF ESSENTIAL INDUSTRIES.

Lord Balfour's Committee on Commercial and Industrial Policy has issued an "Interim Report on Certain Essential Industries." (Cd. 9,032. 2d.) It does not deal with the larger and staple trades, but with certain special commodities which, though of less magnitude industrially, are absolutely indispensable to important British industries, and were supplied from enemy sources before the war. Steps have been taken by the Government to deal with the maintenance of permanent supplies here of synthetic dyes and spelter. In regard to tungsten, it is considered essential to the safety of the nation that this should be manufactured within the Empire after the war on such a scale as to supply domestic requirements, and afford a margin for export, so that any sudden increase in our own requirements may be readily met. This object will be secured if sufficient supplies of ore are ensured, and the eight or nine reduction works in this country are maintained and kept efficient. It is necessary to secure to British manufacturers a first claim upon the supplies of ore available within the British Empire. The Committee sets out the recommendations of the Engineering Industries Committee framed with the object of preventing any attempt on the part of foreign agencies to "corner" the available supplies within the Empire. It is proposed by that Committee that all wolfram or other ores containing wolfram should pay an export duty on leaving the Empire, of £25 per ton, and the Balfour Committee approves of the recommendations on the understanding that the charge of £25 per ton when exported without a Government certificate be imposed as a penalty, and not as an export duty in the proper sense of the term. It is recommended that a special grant be made to manufacturers to cover the extraordinary expense that they have incurred in establishing works and increasing their plant during the war, and it is suggested that the amount and the conditions, &c., should be determined by a special Board, referred to below.

Magnetos naturally receive a good deal of attention in the report, and information has been furnished by the Admiralty, the War Office, and the British Ignition Apparatus Association, and the Ministry of Munitions has also been conferred with. The case of magnetos affords a typical example of "key" industries, and is one which was virtually monopolised before the war by the Bosch Co., of Stuttgart. It is estimated that prior to the war some 300,000 magnetos were imported into this country, and that about 90 per cent. of these were supplied by the Bosch Co. "But for the large stock held in this country by that company, the military position at the outbreak of war would have been very serious." The report says:—

> Since the war a number of British firms have undertaken the manufacture, and with the assistance of certain Sheffield firms as regards magnet steel and magnetos, have succeeded in producing magnetos of a very high quality. The successful establishment and maintenance of the industry in this country are . . . . clearly of very great national importance. The Bosch magneto, is, however, the outcome of a long series of investigations and constant improvements, and the powerful German company, which is also established in the U.S. as a separate concern, is not likely after the war to abandon its market in the United Kingdom without a strenuous effort to recover it. Accordingly, although in our opinion there is no reason why the British industry should not establish itself firmly in due course, we consider that it will require some special assistance during the first few years after the war.

The British Ignition Apparatus Association made the following proposals:—

1. That the Bosch Magneto Co. in London be wound up immediately.
2. That all enemy patents relating to magnetos be voided for their possible duration.
3. All magnetos or other ignition apparatus, including parts for the same, should be protected in the following manner:—
   (*a*) Countries now at war against us total prohibition for at least five years. After this period a minimum of 33⅓ per cent. import duty.
   (*b*) All other countries—a minimum of 33⅓ per cent. import duty for five years, and 20 per cent. minimum after five years.
4. All Government Departments should purchase only British-made magnetos or other ignition apparatus, and specify the same for all subsidised vehicles.
5. No undertaking should be allowed to manufacture magnetos or other ignition apparatus in this country if they are in any way controlled by capital obtained from enemy countries or subjects.
6. It should be insisted upon that all goods be plainly marked on the article itself, where it is clearly visible, with the country of origin.
7. That all advertisements relating to foreign-made goods should clearly state the country in which the goods referred to are manufactured.

The first proposal is already being carried out, and as regards the second, the necessary steps under the rules made under the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, are being taken by the responsible departments concerned in consultation with the British manufacturers.

As regards proposals 3 (*a*) and (*b*), British manufacturers are likely to be able to satisfy the home demand for magnetos within a reasonable time after the war ends. In order to maintain the industry in this country against the competition of the powerful Bosch Co., it will be necessary to prohibit the importation of magnetos of present enemy origin for an initial period of five years after the war, subject to licence. The British magneto is, as a rule, superior in quality to the American, but, in view of the fact that the manufacture has been set up under war conditions, and will require time to adapt itself to normal commercial purposes, it cannot compete in price with the American article. In these circumstances it is recommended that for the period of five years a duty equivalent to 33⅓ per cent. *ad valorem* should be imposed on magnetos and other ignition apparatus and parts thereof imported from all sources other than the present enemy countries or under licence from those countries. At the end of five years the question should be reconsidered with a view to a progressive reduction of the duty.

As regards the fourth proposal above, the opinion of the Admiralty, in which the representative of the Ministry of Munitions was disposed to concur, was that, in view of the progress made by the industry in this country, such an undertaking might now safely be given. Objection has, however, been taken on behalf of the War Office on the ground that it is essential that the Government ought not to be debarred at any time from obtaining the most efficient ignition apparatus from whatever source. In view of the necessity of maintaining the industry in this country, it is recommended that an undertaking should be given experimentally for a period of three years after the war, that the Government Departments which are purchasers of motor cars and aeroplanes will stipulate in their contracts for British-made magnetos. The stipulation should be conditional upon the application of a strict standard of excellence and the maintenance of reasonable prices.

The proposals 5, 6, and 7 raise important questions of general policy to be dealt with separately.

Other essential industries referred to in the report are:—Optical and chemical glass; hosiery needles; thorium nitrate; barytes; and limit and screw gauges. After dealing with these several "typical industries," the Committee turns to the subject of principles which emerge as the result of its investigations, and says:—

"A particular commodity or branch of production which is of great national importance at a given time may not continue to be so, and, on the other hand, new essential industries may emerge in the future.

"The causes which have rendered British trade dependent upon the present enemy countries for the supply of particular commodities are by no means uniform, and the measures required to promote the various branches of industry involved may vary with each individual commodity. The problem will also be affected as new economic and political condition arise and changes occur in the international situation.

"In the future industries of the nature dealt with will always require special and separate consideration, and no general measure will be sufficient to meet their varying requirements. Consequently, it is impossible to lay down permanent and uniform lines of State action in this connection, or to frame an exhaustive list of such industries as may from time to time call for exceptional treatment, or to elaborate in detail the precise measures which may be needed in each case. The special recommendations made in the report may themselves require modification to meet the conditions which may actually exist after the war.

"In these circumstances we recommend the establishment of a permanent Board (which might be called the Special Industries Board) charged with the duty of watching the course of industrial development and of framing from time to time, when necessary, either on its own initiative or on the application of interested departments or persons, detailed schemes for the promotion and assistance of industries concerned with the production of commodities of special character.

"This organisation should take the form of a board of commercial and industrial experts, associated with whatever department of State is entrusted with the care of the commercial and manufacturing interests of the country, and represented in Parliament by the political head of that department. It should be a statutory body with a permanent chairman, and with power to appoint such secretarial and technical staff as it may require from time to time.

"It should be a statutory condition that, except upon its recommendation, no State assistance by way of grant or subsidy should be given to any industry or branch of industry. It should work in close relation and co-operation with the Department of Scientific and Industrial Research, and all other departments of the State interested in the development of industry, and it should always be cognisant not only of naval and military requirements as they affect industry, but also of the current political relationships of this country, since changes in these respects may obviously bring to light fresh 'essential' industries."

The maintenance of efficient and adequate production at reasonable prices must be a condition of the continued receipt by an industry of special State assistance in any form.

The Metric System in the U.S.A.—In view of the great demand for information on the metric system for the use of the U.S. Forces in France, and for the use of the War and Navy Departments at home, as well as for manufacturers of war materials, the U.S. Bureau of Standards has been distributing, on request, copies of its publications on the International Metric System. These include a descriptive pamphlet, a graphic chart, a metric comparison scale, a circular giving definitions and tables of equivalents, a report on the metric system in the export trade, and a supplement to the table of equivalents giving the millimetre-inch equivalents. In view of an order recently issued by the Ordnance Department, adopting the system for use for specified purposes, the demand for the charts for the instruction of officers, aviators, and others, has been especially heavy.

WAR ITEMS.

Trading with the Enemy.—The " London Gazette " for May 10th contains official certification of territory in Russia which, in connection with Trading with the Enemy Proclamations, is regarded as territory in hostile occupation.

Electrical Lieutenants.—By an Order in Council it is declared that Commissioned Warrant Officers of the Electrician Class who have completed three years' service in Commissioned Warrant Rank will on retirement be granted rank corresponding to that of Lieutenant, R.N., with the title Electrical Lieutenant.

Ministry of Munitions Orders.—By Order of the Ministry of Munitions, as from June 1st a variety of engineers' and machinists' small tools (which are specified—see *London Gazette*, May 10th) must not be manufactured without special licence. Persons engaged in the business are to make returns concerning their business as required.

An Order has also been issued revising the maximum prices of sulphuric acid as fixed by Order dated May 29th, 1917.

Exemption Applications.—At Blackpool Tribunal, Mr. C. Furness, tramways manager, appeared for a tramway permanent-way foreman, aged 35, Grade 2, and married. He stated that they ran 1¼ million car-miles per annum. Owing to the lack of material the tramway track was in a worse condition than ever before. He had recommended to the Committee putting on another gang of at least 30 men, otherwise they would run to a standstill." It would mean the top-covered cars coming off, and it was, therefore, more essential than ever that the man should be retained. He was a foreman in charge of 30 men. Temporary exemption until September 30th was granted.

At Heckmondwike, the District Council applied for a stoker at the electricity works. The application was lodged some months ago, but was adjourned. The Council stated that the works could not be carried on with any less staff than was there at present, and all efforts to get a substitute had failed. The taking of this young man, who was now the only stoker, would stop the works, and deprive many industrial establishments of power and light. The National Service Representative held that the Tribunal had now no jurisdiction, and submitted that power could be got from Thornhill. It was agreed that a deputation should interview the Dilution and National Service Authorities at the regional headquarters.

At Shoreditch, J. Hind, aged 42 years, C 1, Eldon Street, E.C., electrical merchant, made a fourth application on business grounds, and was granted four months, Sec. B, V.T.C.

At Carlisle, the National Service Representative appealed against exemption granted to R. J. Cooke (38, Grade 2), a driver in the employ of the Tramway Co. The manager urged that the man's services were very much needed for instruction purposes now that women drivers were to be allowed. The appeal was acceded to, and the exemption cancelled.

The West Kent Appeal Court has disallowed exemption, with 28 days' grace, to M. A. Jarrett (30, Grade 2), a driver on the Maidstone Municipal tramways. The local tribunal had previously withdrawn his exemption.

On a review, the Clacton-on-Sea Tribunal has confirmed conditional exemption held by A. H. Jennings (38), who has sole charge of the electricity plant and the X-ray apparatus at the Middlesex Military Hospital, on the ground that he is in a certified occupation.

At Bath, the National Service Representative asked for the withdrawal of exemption held by two drivers with the Electric Tramway Co., A. C. Derrick (31, Grade 2) and W. E. Greening (36, Grade 2) The company did not oppose the application, although the men were skilled drivers, and would be much missed. The Clerk: Perhaps when there have been a few fatalities the National Service Authorities will alter their demands. The exemptions were cancelled.

The Epsom Rural Tribunal has refused exemption to W. H. Pack, engineer at the Leatherhead electricity works.

An appeal by J. A. Brine (40, B 1), electrical engineer, of Chiddingstone, has been dismissed by the West Kent Appeal Court.

An appeal to the West Kent Appeal Court by J. H. Baxter (31, Grade A), electrician, of Tovil, Maidstone, has been rejected by the Court.

The Southport Tribunal has granted exemption until June to a student of electrical engineering at a Manchester College, to enable him to sit for his examination. He is 18, and in Class C 1.

At Oxford, the Electric Tramways Co. appealed for M. F. Sadler (34, Grade 2), unit adjustor. The manager, Mr. A. A. Tyler, said that the man was of poor physique, but was just able to do the work, and they had no man they could train to take his place. Captain Segar urged that in a month a man could be trained to do the work. The appeal was refused, the calling-up being delayed for two months.

Before the Herts Appeal Court, an appeal was filed by M. J. Connari (Grade 2), electrical engineer, of Watford, but exemption was refused, together with a request for medical re-examination.

At Swindon, the Corporation appealed for A. J. Vizor (40, Grade 1), tramway inspector; A. E. Chislett (Grade 1), C. Tunley (34, Grade 3), and F. Cole (38), drivers. The manager (Mr. T. Medcalf) said that it was necessary to have thoroughly expert drivers on the Corn Exchange route, and he pointed out that the trams were now carrying 35,000 more passengers weekly than before the war. Vizor was given six months, Chislett a final month, Chamberlain and Cull six months each (temporary), and the cases of Tunley and Cole (rejected) were not dealt with.

At Dover, the Corporation electricity department appealed for further exemption for G. Hopkins (Class A), coal and ash trimmer. He was ordered to be called up in three months' time.

At Folkestone, the cases of A. Goodenough (33, B 1), commercial and analytical clerk, and Mr. Jenkins (32, A 1), chief clerk, with the Electricity Supply Co., were considered. Col. Daniel said that he was inclined to say " Blow the regulations," and use common-sense; he thought it imperative that these men should stay. The former was given conditional exemption, and the latter three months.

At Chatham, in the case of 18 employés of the Tramway Co., which were to be reviewed, it was decided that the whole of 40 cases should be considered *en bloc*. Meanwhile the whole question is being considered by the Dilution Officer, the Labour Bureau, and the Local Advisory Committee. Three of the men, M. Poulter (37), motorman; A. Tonge (39), armature winder; and N. S. Metcalf (34), motorman, having left and entered the dockyard, had their exemptions withdrawn, and it was decided to represent the facts to the dockyard authorities.

Brixworth Tribunal has granted final exemption to June 30th to an electrical engineer at Althorp, who is in charge of the waterworks there.

BUSINESS NOTES.

Patent Application.—Mr. A. G. M. Michell, of Melbourne, is applying for an extension of Letters Patent No. 875, of 1905, for " Improvements in thrust and like bearings."

A Large Stoking Plant.—Erith-Riley stokers, constructed in Lancashire by Erith's Engineering Co., Ltd., 70, Gracechurch Street, London, have been ordered for the largest-unit boilers in Europe, viz., for double-ended Richardsons-Westgarth boilers, 20,700 sq. ft. heating surface, hourly evaporation 100,000 lb. from and at 212°, corresponding to about 6 tons slack coal hourly, at the Bow power plant of the Charing Cross Electric Supply Co., Ltd. These units are remarkably compact, the total area occupied, including the stokers, being only 23 × 36 ft., or 828 sq. ft. For convenience of working, a central wall divides the unit into two parts, each with its 12-retort Erith-Riley stoker burning 3 tons of coal an hour.

At Fulham electricity works, the Erith-Riley stokers are two-thirds the size—viz., eight-retort stokers burning 2 tons of coal hourly; all sizes, from four-retort to twelve-retort inclusive, are used in British central stations, and many repeat orders have already been completed.

Australian Electrical Trade.—In our last issue we referred briefly to the annual report of the Electrical Employers' Association of New South Wales. We have since been favoured with a complete copy of the report, which is signed by Mr. A. D. Stevenson, the president, and Mr. N. Phelps Richards, the secretary. Supplementing the notes already quoted, we find that inability of power houses, mines, and industries to obtain extension machinery has gradually been bringing development of the electrical trade to a standstill. "Had it been possible to procure heavy machinery, there is every reason to believe that the trade would have progressed normally in spite of the war. The supply of the smaller materials needed, such as wires and accessories, although dear, has kept pace reasonably well with the demand. Individual firms, especially those engaged on maintenance work, have kept themselves fully and profitably occupied, but many of our less fortunate members feel the effects of the growing depression." In regard to the new local manufacture of accessories mentioned last week, the report says:—"It remains to be seen whether these manufactures can be successfully continued in the face of a renewal of competition from abroad, but the fact is established that such goods of excellent quality can be made in our workshops. It is reasonable to expect that this development of our industry as applied to goods of a special nature—for instance, such as cannot be standardised and made in large quantities—has come to stay. The advance of scientific and technical training in our university and technical schools will undoubtedly contribute to this result." The report refers later to useful activities of the Association in respect to the restriction on supply of electricity in Sydney, a certain measure of relief being obtained, also in regard to industrial arbitration, conditions of contract, wiring rules, apprenticeship, &c. The conditions of contract duly adopted for wiring work have been printed and put on sale, and the various Government departments have been approached with a view to the adoption of the conditions for Government as well as for private work. The conditions of contract for the supply of materials to the various Federal and State Government Departments, Municipal Councils, &c., have been under attention. As a general rule, the Association finds that these Departments, when brought face to face with the question prepared to meet members in a reasonable spirit. The Supply Houses Committee has completed a model set of standard conditions for use with contracts for annual supplies, for application after the war.

In the *Board of Trade Journal* we find remarks on the present position and the future prospects of the electrical industry in Australia which were made by the President of the New South Wales Section of the Electrical Association of Australia at its annual meeting held recently. He stated that the war had given a great impetus to the manufacture in Australia of electrical apparatus, and that large orders had been placed locally which would otherwise have gone abroad. Had the firms been quite prepared to execute the orders, they would have received a much larger volume of work. Power is required for the development in New South Wales of large electro-chemical and electro-thermic industries, for which there is said to be a distinct field. It is probable that eventually the water powers of New South Wales will be harnessed, in spite of the fact that coal is very plentiful, of excellent quality, and cheap.

Considerable water power can be developed economically for the purpose of establishing manufactures, and the result of investigations shows that 100,000 kw. could be delivered on the sea-coast line, derived from the waters of the mountain ranges of the State. This would enable producers to manufacture all products of the electric furnace, including not only steel, but carborundum and alundum as abrasives, graphite for electrodes, and to engage in the preparation of lubricants, calcium carbide for lighting, cyanide for fertilisers, alkali for all purposes, and, in all probability, aluminium. There being no alternative—delivery being required soon—orders for electrical machinery have been placed with local manufacturers at exceptionally high prices. When the war is over, however, the position will be altered. Active competition from established works abroad will be intensified owing to many manufacturing countries making a bid for the trade. Local factories will not be in a position for some years to manufacture on a large scale, and the only way of meeting this competition will be to impose a heavy protective duty or to reduce the cost of labour. A reduction of wages, however, is very unlikely.

Dissolutions and Liquidations.—W. P. Thompson and Co., patent agents, 285, High Holborn, London, W.C. 1.—Messrs. W. P. Thompson & H. Sefton Jones, dissolved partnership as from October 1st, 1917. The assets and goodwill have been acquired by the acting partner, Mr. H. Sefton Jones, who will attend to accounts. Mr. W. P. Thompson remains interested in the firm of W. P. Thompson & Co., of Liverpool, as hitherto. Mr. H. Sefton Jones, who has been sole acting partner in the late firm for more than 20 years, continues the London business at the above address, in partnership with Messrs. A. E. Odell and A. J. Stephens, as Sefton Jones, Odell & Stephens.

Pintsch's Electric Manufacturing Co., Ltd.—Meeting June 14th, at Friars House, New Broad Street, E.C., to hear an account of the winding up from the liquidator, Mr. H. W. Kirby.

Calmon Asbestos and Rubber Works, Ltd., London.—Winding-up order made May 7th.

Automatic Electric Block Signalling Co., Ltd.—Meeting, June 19th, at 47, Parliament Street, London, S.W., to hear an account of the winding up from the liquidator, Mr. A. Colls.

Calvert's Circulation Fuel Economiser, Ltd.—Meeting, June 17th, at 36, John Street, Bedford Row, London, to hear an account of the winding up from the liquidator, Mr. F. J. Drane.

Brimsdown Lamp Works, Ltd.—The controller, Mr. H. J. Morland, has applied for his release.

Taylor & Co., mica merchants, 40, Hatton Garden, London, E.C.—Miss Taylor, the founder of this business, and Mr. Moritz Ignatz Bergl have dissolved partnership. Mr. Bergl has retired. The business will be continued under the same name, and at the same address, by Miss Taylor, with skilled engineering assistance.

Our Australian contemporary, *Tenders*, states that under the Trading with the Enemy Act, the Minister of Customs has directed the winding up of the business in Australia of the Australian Thermit Co., Ltd.

Catalogues and Lists.—Messrs. Johnson & Phillips, Ltd., Charlton, S.E. 7.—Twelve-page list, S 2/1—4, containing full description, with half-tone and diagrammatic illustrations of their all-steel draw-out truck type switchboards.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4. — Twelve-page illustrated price list (No. 10,401), giving particulars of various types of fittings for industrial lighting; also a supplementary list giving illumination data for industrial lighting, including a double-page illumination chart. Copies of both lists may be had on application.

The Claughton Co., 8, Exchange Street, Manchester.—Copy of No. 1 of a small monthly magazine published by them—"Power Plant Transmitter"—of which copies will be sent to anyone interested.

Book Notices.—*Metric Weights and Measures and British Equivalents.* By A. J. Lawson, M.Inst.C.E. London: Eyre and Spottiswoode, Ltd. 211 pp. Price 5s. net.—This work, which is printed in English and Italian, consists mainly of tables of British decimal coinage, metric and British weights and measures, which were originally prepared by the author for his own use, and have now been extended with a view to their being of service to others; it is published under the ægis of the British-Italian Commercial Association, a body which has rendered great services to both countries by fostering trade relations between them, since its formation in 1916 as the British-Italian League (Economic Branch). The author has taken great care to ensure the accuracy of all his data, and of the tables as printed.

The contents cover a wide range of subjects, embracing practically all the classes of goods interchanged between Italy and Great Britain, as well as their coinage systems; but their purpose is far more general, as the tables will be of the greatest use in engineering and other works, shops, offices, &c., in all branches of commerce and industry in which conversion from British to metric units, and *vice versâ*, is necessary. The author regards the early adoption of the decimal system in this country as a matter of certainty, and in dealing with coinage has based his tables upon the proposals of the Decimal Coinage Bill which is now before Parliament—the pound sterling subdivided decimally. Tables for the conversion of prices from the old to the new system are given, as well as for converting lire into sterling, and *vice versâ* (at par value). Next follow very full tables of conversion for measures of weight, length, area and volume, tables of multipliers, specific gravities of materials, tensile strengths, pressures, stresses, areas and circumferences of circles, thermal data, gravity, railway tables, mensuration, tables for use in curve-ranging, earthworks, &c., and in appendixes a number of interesting items. It is impossible to examine this mass of tabular matter in detail, but we can say at once that—while of course there is no limit to the variety of tables of compound values that could be drawn up, and this work does not profess to cover them all—we have never met with any similar production that meets so many and so varied needs; the tables are admirably set out and printed on stout paper, and the book is strongly bound. Objection may be taken to the excessive number of significant figures employed, extending in many cases far beyond the requirements of commercial or industrial users; but we understand that the author's aim was to ensure against deficiency in this respect—any user, of course, can employ just as many figures as he finds necessary and sufficient. We heartily welcome this work, which arrives at a most opportune moment, and we hope that its sphere of usefulness will shortly be enlarged by the adoption of the decimal system all round.

The current issue of *The Channel* contains articles on "The Efficiency Ratio of a Steam Turbine," by R. Gardner; "The Application of Electricity to Various Auxiliaries on Shipboard," by H. L. Hibbard; "Notes on Electric Furnaces," by F. H. Whysall; and a variety of Clydeside and other interesting items.

"Annual Report of the Smithsonian Institution, 1916." Washington: Government Printing Office.

Messrs. Constable & Co. will publish almost immediately a new edition, re-written and enlarged, of "Industrial Electrical Measuring Instruments," by Kenelm Edgcumbe, which has been out of print for some little time. Messrs. Constable will also publish almost at once "The Production and Treatment of Vegetable Oils," by T. W. Chalmers, in their "Engineer Series."

France.—A new company has lately been formed at Boulogne, near Paris, with a capital of £40,000 and the title La Société de l'Usine Moderne de Location de Force Mor Motrice de Billancourt, the object apparently being to establish electrically-operated workshops to be let out to small manufacturers.

Trade Inquiry.—A British subject in Marseilles desires to secure agencies for British manufacturers of electrical material, accessories, glass shades, &c., for house and factory lighting. Ref. No. 126, *Board of Trade Journal.*

Trade Announcements. — Messrs. Venner Time Switches, Ltd., have removed their offices and works to 6, Earl Street, Westminster, S.W. 1, where all inquiries should be addressed in future. Telephone No.: "Victoria 4550."

Messrs. Tredegars, Ltd., of Diana Place, Euston Road, announce that their manager (Mr. Bedbrook) has opened a new depôt at Birmingham at 47, Exchange Buildings, and will attend to all inquiries for that district.

Messrs. Drake & Gorham, Ltd., announce that the address of their wholesale department and stores will in future be 67, Long Acre, W.C. 2, where they will be able to stock large quantities of metal-filament lamps and other electrical requirements.

LIGHTING AND POWER NOTES.

Bexhill-on-Sea. — Price Increase. — The T.C. has decided further to increase the price of electricity by 10 per cent., a total of 25 per cent. on the pre-war scale, and to advance the meter rent to prepayment consumers from 1s. to 2s. 6d. per quarter.

Birmingham.—War Bonus.—The City Council, last week, granted the 12½ per cent. war bonus to manual workers in the certified departments of the Corporation (electricity, gas, tramways and water).

Brighouse.—Year's Working.—There is a surplus of £330 on the working of the electricity undertaking for the year.

China.—The *Board of Trade Journal* contains the following notes from H.M. Consul-General on the chief industries of the Province of Yunnan:—

There are two privately-owned companies at present engaged in the electric lighting industry in the Province of Yunnan.

The first to commence operations, and the largest, is a company at Yunnanfu, with a power house at Shih Lung Pa, where the fall of water from the lake into the river is utilised. The plant consists of two 150-kw. alternators driven by turbines. Electricity is generated at 23,000 volts, three-phase, 50 cycles, and is brought into the city at this voltage by a transmission line some 30 English miles long, and transformed down at a sub-station at the West Gate of the city to 3,000 volts, at which voltage it is distributed to various centres, and again transformed down to 110 volts for lighting purposes.

Difficulty has been experienced with the transmission line, and a station was erected last year about halfway with lightning arresters, but without very much result. Energy is sold at a flat rate of $1 per month per 16-c.p. lamp, and at the rate of 30 cents per unit for consumers who have meters. The total cost of the installation is estimated at about $600,000. The machinery was manufactured by Messrs. Siemens, Schuckert & Co., and supplied through a local agency.

The contract for all supplies during the war has been secured by a British firm, and it is hoped that very shortly a British engineer will be engaged to replace the German who was formerly in charge of the plant.

The second installation is at Mengtsz, and consists of a British-made alternator, direct coupled to an engine of British manufacture, which is supplied with steam from a boiler of the same make. The alternator works at 6,600 volts, three-phase, 60 cycles, with an output of 80 kw. It is intended to connect up with the neighbouring tin mines of Kotchiu by a high-tension transmission line, a distance of about 15 miles, and to supply the mines with cheap power and light. It is estimated that 1,000 h.p. will be required for the mines alone, which will necessitate the installation at Mengtsz of a turbine plant of this capacity and of the latest design. The engine room has been designed with a view to accommodating two 1,000-h.p. steam turbine sets.

High-tension lines are run through the City of Mengtsz to the various transformers, at which the voltage is stepped down to 110 for lighting purposes. The only coal available is a very low quality soft grade, necessitating the use of steam blowers with the boilers. Electricity is sold to the city at the same rates as are charged by the first-mentioned company. The plant has been in operation about 15 months.

Continental.—Spain.—In a debate on railways, in the Senate on May 3rd, says the *Daily Mail*, Senor Cambo said the Government was occupied with a large scheme for the development of hydro-electric energy, and hinted at the existence of a plan to utilise this energy for the running of the main railways of the country. The industrial development of the country is hung up for lack of communication and transport, which is dependent on coal at present. It is stated that there is enough water power in Spain to do the whole work of the country, and it is of interest to note that practically all the hydro-electric plant in the country is of German manufacture, whose usual commercial forethought has been displayed in a systematic cultivation of the subject, as well as in a good deal of surveying and buying of properties where power can be developed on a large scale.

A concession has recently been granted for the establishment of a plant to utilise the water power of the River Ebro near Merindal de Castilla la Vieja in the generation of electrical energy for lighting and power purposes.

La Sociedad Electra Vasca Montanesa has lately applied for a concession to utilise certain available water power near Santander. It is proposed to establish an electric power station in which two turbo-generator sets will be erected, one of 1,050 h.p. and the other of 520 h.p.

Denmark.—A trust company has applied to the Danish Government for a concession to utilise the Gude river for electric generation purposes according to plans already drawn up by the engineers, Thomsen and Faber. The damming of the river will involve the flooding of some 1,000 acres of land; but as the trust has come to an understanding with the owners regarding indemnification for displacement, the realisation of the scheme is ensured.

Austria-Hungary.—On Saturday last, according to the *Daily Mail*, the large hydro-electric power station at Cavedine was bombed and destroyed by Anglo-Italian airmen, and it will be some time before it can be put in working order again. Ordinarily these works supply light and power to Riva, Trent, and most of the other towns and communities in the Lower Trentino. An important effect of the raid will be the stopping of the electric railway from Trent, up the Val di Sole, to Fucine, an important link in the Austrian line of communications.

Norway.—The power-transmission line from Florli to Stavanger was recently completed, and is ready for service, awaiting only the completion of the power plant at Florli. This will make 12,000 h.p. available for the Stavanger Electric Co., to be used for lighting and power.—*U.S. Commerce Reports.*

Sweden.—Two new companies have lately been formed—one at Uttran and the other at Tillinge—to establish small central electricity supply stations in the respective towns.

A new company has lately been formed at Mgolby, with the title the Elfkulla Kraft Aktiebolag, to establish a small electricity generating station in that town. The Aktiebolag Elektrolytverke is the name of another new undertaking which has lately been organised at Vasteras, with minimum and maximum capitals of respectively £140,000 and £420,000, to establish works for the electrolytic production of metals.

Cork.—Coal Shortage.—The Electric Lighting and Tramways Co., Ltd., has issued an appeal to users to economise in every way in the consumption of electricity. The coal shortage threatens a very serious situation in relation to the electricity supply.

Darwen.—Linking-up Scheme.—At the last meeting of the T.C., Councillor J. B. Thornley said the Government scheme for linking-up the electrical stations from Darwen to Colne was receiving consideration, but the fact that none of the towns had any surplus output defeated one object the Government had in view—namely, for one Corporation to come to the assistance of another in case of emergency.

Year's Working.—There was a loss of £1,867 on the electricity undertaking for the past year.

East Africa.—Lourenco Marques.—The Electric Light Co. has notified consumers that if they sign an agreement, they will be charged 6s. monthly for five units, with 1s. 3d. for each additional unit, plus 2s. meter rent. Those who do not sign the agreement will be charged the old rate of 2s. 3d. per unit, plus 4s. monthly for meter rent.

Edinburgh.—Fuel Economy.—A Sub-Committee of the Electric Lighting Committee has had under consideration the position of the Portobello power station in connection with the Coal Conservation Committee's report. Several plans were submitted to the Sub-Committee by Sir Alex. Kennedy with reference to the station, showing the extended area supplied by the city, the convenience of the station to the Lothian coalfields, and the possibilities of extension. The Sub-Committee remitted the whole matter to the full Committee, with a view to its being submitted to the Town Council, which will decide what action should be taken.

Glasgow.—A Provisional Order to authorise the Clyde Valley Electrical Power Co., of Glasgow, to raise additional capital, has been submitted to the Secretary for Scotland, and is at present under consideration.

South Africa.—Strike.—The engineers and fitters employed at the Johannesburg municipal power station are demanding an increase in their wages from 2s. 10d. to 3s. 4½d. per hour. On May 11th, the employés, whose demand was not granted, came out on strike, and from noon all the services were held up. At a mass meeting the men decided not to return until all their demands were conceded. The T.C. after a meeting decided not to agree to the men's demands. The centre of the city is without light, and no tramcars are running. The Strike Committee permitted a certain amount of lighting in the suburbs, but owing to the T.C.'s attitude the facilities for lighting the suburban areas have been withdrawn.

Kettering.—Plant Additions.—The Electricity Committee has recommended the installation of new circulating water pipes, at a cost of £425, and that the necessary parts be obtained for the repair of the air pump, a P. 4 certificate having been obtained in each case.

Street Lighting.—The Committee has decided to discontinue until further notice all public street lighting.

Limavady (Co. Londonderry).—The Board of Guardians, following on a report by Mr. A. Robinson, L.G.B. inspector, have approved of a suggestion that they should approach the local Technical Committee with a view to a joint electric lighting installation.

London.—Southwark.—Price Increase.—The Electricity Committee recommends a further increased charge of 10 per cent. to all consumers of electricity as from March 31st last.

Price Increase.—The Kensington and Knightsbridge Electric Light Co., Ltd., notifies a further 10 per cent. increase in the charges for electricity to private consumers, making 30 per cent. in all, as from July 1st.

L.C.C.—Loan Sanctions.—The Finance Committee recommends the sanction of the Council to the borrowing of £3,000 by the Hammersmith B.C. for electricity purposes, and of £18,195 by the Woolwich B.C. for new buildings, boiler-house plant, coal conveyer, &c., for the electricity department.

Lambeth.—Restriction Order.—The B. of G. has had its attention directed to the Order reducing the lighting in its various institutions, and has considered the desirability of approaching the B. of T. with a view to securing a special licence to permit the Guardians to have sufficient supplies to meet their requirements; but before taking action in this direction, and in order to ascertain that strict economy is being exercised, it has instructed the chief officers of the institutions and also the caretakers of relief and other stations to submit a monthly return showing the meter readings to date as compared, where possible, with the figures for the corresponding period of last year.

Maidenhead.—The T.C. has offered a supply of power to the new works of Dolland & Co., Grenfell Road, at 1¾d. per unit for the first 2,4000 units per annum, 1½d. for the next 10,000, and 1¼d. beyond, with a minimum of 24,000, and ordinary rates for lighting.

Nelson.—Price Increase.—The Electricity Committee has decided to increase the charges for electricity by ½d. per unit for lighting and ½d. per unit for power.

New Zealand.—A licence for 42 years has been granted to the Waikuku Town Council to erect and maintain electric transmission lines for lighting, power, and heating. The price of electrical energy is not to exceed 1s. per unit for lighting purposes, and 6d. per unit for power, heating, or cooking purposes. "Lighting purposes" includes the operation of motor-generators for lighting purposes.—*Board of Trade Journal.*

Sheffield.—At the annual meeting, last week, of the Sheffield Forge and Rolling Mills, the chairman, Mr. C. E. Siddall, in the course of his remarks stated that the tonnage output had increased 50 per cent. during the past two years, and the whole of their mills would be electrically driven; he was hoping to see the day when there would not be a steam engine in the whole works. He was convinced that electricity was the coming method of operating all machinery; it was also the cleanest method.—*Sheffield Daily Telegraph.*

Slaithwaite.—Renewal of E.L. Order.—The U.D.C. has decided to apply for a renewal of the Slaithwaite Electric Lighting Order, which expires in July.

Stamford.—Proposed Price Increase.—The T.C. has decided to oppose the proposed increase in the charges for electric light by the Stamford Electric Light Co., which has made application to the B. of T. for a revision of the rates provided for under the Electric Lighting Order of 1900.

Swindon.—Revised Charges.—The T.C. has adopted the following new scale of charges for energy:—Public lighting, 20 per cent. increase; power (small consumers), 3d. per unit; ditto (large), 1·8d.; heating, 1½d.; tramways, 1·8d.

United States.—Niagara Water Power.—Chief Justice Meredith, with Judges Kelly and Sutherland, as a Special Commission under the Public Utilities Act, has decided that the Electrical Development Co., which is controlled by Sir William Mackenzie and his associates, is not entitled under its charter to develop more than 125,000 H.P. at Niagara for commercial uses, and that the contention that it may exceed this amount if the average quantity used does not exceed 125,000 H.P. is unfounded.—*The Times.*

Wakefield.—Loan Application.—The City Council, last week, decided to apply to the L.G.B. for sanction to borrow £6,000 for electricity works extensions.

Welsh Water-power Resources.—A Committee has been appointed by the Anglesey County Council to consider the safeguarding of the public interests in connection with the development of the water-power resources of North Wales, and to confer with representatives of the other North Wales County Councils and of the North Wales Branch of the Welsh National Association for Reconstruction as to any steps that should be taken to secure this object.

TRAMWAY AND RAILWAY NOTES.

Australia.—Year's Working.—The annual report of the Fremantle (W.A.) municipal tramway and lighting board to August 31st, 1917, shows that shortly the various tramway routes will be supplied with electricity from the Government power station at Perth, but that some delay will be occasioned in the supply for lighting and power owing to the non-arrival from England of the necessary transformers. The net profit on the whole undertaking for the year was £7,638, against £10,640 for the previous year, the reduction in amount being due to an increase in the working expenses. Traffic revenue, £36,083; lighting revenue, £25,799; total revenue, £65,352; working expenses, £51,328; interest, £6,846; net balance, £7,638; car-mileage, 606,754,178 miles; passengers carried, 4,995,860; average car revenue per mile, 14·272d.

Belfast.—Lock-out.—The Corporation has decided to terminate by a week's notice the engagement of all the tramway employés unless the latter withdraw summonses issued against the Corporation for failure to carry out an award of the Committee on Production, giving the men an increase on their war wages of 8s. weekly. The decision means that the whole tramway service of the city will be suspended. The award affected 800 men.—*Morning Post.*

Bradford.—War Wages.—To settle the problem of the increase of wages of the employés in the various Corporation departments, the War Wages Committee, last week, decided to offer a general increase of half-a-crown per week, as from March 1st, bringing the advances to 20s. above pre-war rates for men, 13s. for women, and 10s. for youths and girls. This means the suspension of the operation of the award.

Traffic Restrictions.—Mr. C. J. Spencer, the municipal tramway manager, has reported that, in view of Government restrictions on tramway traffic, further curtailment of car services is likely to become necessary from time to time. The Committee has authorised him to alter services as he may deem advisable, as the needs arise.

Burnley.—Strike.—The permanent-way men in the employ of the Corporation tramway department came out on strike last week, claiming to participate in a recent war advance of pay granted to members of the National Union of General Workers engaged in the gas department.

Continental.—Germany.—According to the *Pall Mall Gazette*, a Zurich telegram says the Frankfort-on-Main tramway power house was completely destroyed by an explosion which occurred there last Friday morning. The explosion, the cause of which has been carefully concealed, destroyed many buildings in the vicinity, and the tramway service cannot be resumed for several days.

Denmark.—The growing scarcity of oil is interfering with the oil-driven traffic in Denmark generally, but in Copenhagen the electric tramway service, thanks to the supply of energy from Sweden by the Helsingborg-Elsinor cable, has been continued uninterruptedly during the past year, a surplus even allowing of large supplies being furnished to the Nordsjælland electric works for traffic and general purposes. The Boulevard tunnel section of the Copenhagen tramways is completed, and was opened to the public on December 1st last.

Darwen.—Year's Working.—There is a loss of over £930 on the tramway undertaking for the past year.

Japan.—New Underground Railway.—On account of the great congestion in the streets of Tokio, and the urgent demand for better transportation facilities, plans have been completed for the immediate construction of a subway system, 9½ miles long. This will be built in a fairly straight line under the busiest part of the city. The construction work is to be of reinforced concrete throughout, with a track gauge of 4 ft. 6 in., which is widely used in Japan. The third-rail system is to be employed. The sum of 21,000,000 yen has been decided upon as necessary for the project, or at the rate of 2,210.000 yen per mile (1 yen = 50 cents). High-speed service, at five-minute headway, will be given between 5 a.m. and 1 a.m. No cars will be operated from 1 to 5 a.m. The fare is to be 5 sen (2½ cents), and the estimated net profits are given at $970,000, with a guaranteed dividend of 8 per cent. to the promoters. Substantial business men throughout Japan are backing the project, and it is understood that work is to begin at once. In comparing the estimated cost of this project with that of similar undertakings elsewhere, the purchasing power of the yen in Japan must be considered. This is not far inferior to the value of the dollar in the United States. Labour is, of course, far cheaper than in this country, and only a small proportion of the total amount mentioned represents labour costs.

Year's Working.—The report of the Imperial Government Railways for the year ended March 31st, 1916, contains a section devoted to tramway lines proper. The results of the working of these for the year under review are:—

	Electric.	Other.
Number of tramways ...	64	74
Mileage open	667	587
Mileage under construction	232	56
Passengers carried	624,890,286	13,592,881
Passenger earnings (yen) ...	24,882,962	1,236,861
Goods hauled (ton)... ...	468,158	843,376
Freight earnings (yen) ...	334,926	466,864
Total revenue (yen) ...	38,666,330	1,991,963
Total expenses (yen) ...	25,377,798	1,519,867
Profit (yen)	13,288,532	472,110

—*Electric Railway Journal.*

Kettering.—Electrical Vehicle Statistics.—The electrical engineer has submitted the following figures in connection with the electrical vehicle for the nine months ending March 31st last, viz.:—

Total mileage covered	3,500
Tons coal carted	5,409
Tons clinker (works)	993
,, ,, (destructor)	90
Units used, 5,840, at 1d.	£24
Labour, maintenance, licences, insurance	£238
Interest and sinking fund	£155

Running costs for the year, 1s. 3d. per ton.
Estimated saving on the basis of 1s. 10d. per ton, £190.
The vehicle has not been out of commission for a single day.

Liverpool.—Year's Working.—With further reference to our note, page 422, May 3rd, the total revenue of the Corporation tramways for the year ended December 31st, 1917, was £865,645; operating costs, £575,267; gross profit, £270,378; interest, £50,401; sinking fund charges, £52,734; reserve, renewal, and depreciation fund, £42,243; contribution to general rate account, £125,000. The net profit for the year amounted to £167,243, an increase of £21,271, as compared with 1916; traffic receipts increased by £80,435; passengers carried were 172,842,494, an increase of 15,205,899; average car earnings per car-mile 15·56d., as against 13·97d. for 1916, an increase of 1·59d. Total capital expenditure to date, including purchase money paid to the Liverpool U.T. and O. Co., £2,068,430; total sum set apart for the sinking fund and redemption of debt, £1,508,361. Since the undertaking came into the hands of the Corporation £887,032 has been placed to the credit of the reserve, renewals, and depreciation fund, and £922,899 to the relief of rates. Up to the present free military passes, value £63,412, have been granted.

London.—B. of T. Report.—Col. Pringle, the B. of T. Inspector, issued on May 9th the report of his inquiry into the collision between two tube trains near Warwick Avenue Station on February 25th. He finds that the collision was due primarily to the third train travelling at a speed and in a manner at variance with the company's rule on an occasion when the automatic signals were found to be at danger; and, secondarily, to the fact that the rear of the train with which it collided was not illuminated, as it should have been, by red lights. The responsibility, in the first instance, rests with the motorman Keith and conductor Cartledge; and, in the second, with conductor Watts and gateman Byrne. Col. Pringle suggests that a permanent oil tail-light should be utilised in preference to the existing electric system of tail lighting.—*Evening News.*

L.C.C. Economies.—Reporting upon the establishment by the B. of T. of a Committee to control tramways, the L.C.C. states that it has been called upon by this Committee to reduce coal consumption by 15 per cent. at least. The Committee suggests that coal economies can be made by withdrawing services for the whole, or part, of Sundays, by stopping cars earlier in the evening, &c.

The Highways Committee recommends that, owing to the difficulty experienced in obtaining men for car washing, a limited number of women be employed in this capacity at the rate of pay of 4s. 7d. a day or night, plus 5s. a week war wages.

The revised fares on the Council's tramways will come into operation in South London to-morrow (Saturday); North of the Thames the date will be arranged later, as a number of the services are run in conjunction with those of other authorities.

Londonderry.—Third Reading.—The Bill promoted by the Corporation for powers to run trolley vehicles and omnibuses, and supply electricity, &c., has been ordered for third reading; a clause has been inserted limiting the borrowing powers to £50,000 in respect of trolley-vehicles and motor-omnibuses, pending any action on the part of the Corporation to extend the city boundaries. —*Belfast News Letter.*

Longridge.—New Railway.—The Light Railway Commissioners have held an inquiry into the proposal to construct a light railway from Longridge to Hellifield. The scheme is estimated to cost £210,000.

Manchester.—Workmen's Fares.—The Electrical Trades Union, on Monday, protested strongly against the withdrawal of workmen's fares on the Corporation tramways. The Trades Council and Labour Representation Committee is to be asked to discuss means of having the fares restored and the time extended.—*Manchester Daily Despatch.*

Nelson.—Fare Revision.—The Tramways Committee has decided to abolish ½d. fares, subject to the approval of the T.C.

Ramsbottom.—Year's Working.—The total working expenses of the tramway undertaking for the year ended March 31st amounted to £4,158 and the income to £3,588, leaving a loss of £570.

Sunderland.—Sunday Services.—The Tramways Committee recommended that, until further notice, the whole of the tramway service be discontinued on Sundays. Alderman New, chairman of the Committee, in moving the adoption of the report, said it was probably a preliminary to further curtailment. It was the opinion of the Committee that the discontinuance of Sunday traffic would not dislocate the services. Financially, Sunday was one of their best days, and the stoppage would mean a drop in the revenue of £9,400; but as the saving in wear and tear and for power would be about £5,000, there would be a net loss of about £4,400 per annum. The proposal was unanimously adopted.

Warrington.—Traffic Restrictions.—The Sunday service on the Corporation tramways will not commence until 2 p.m. in future, and the extra late cars on Mondays and Saturdays are to be discontinued.

TELEGRAPH AND TELEPHONE NOTES.

Decoding Telegrams.—To facilitate the work of decoding outgoing cable messages at the United States Censor's Office, it has been suggested that the number of the page of the code book from which the code word or cipher is taken be inserted after each word or phrase in the translated copy accompanying such messages. The proposal has met the approval of Commander A. B. Hoff, Cable Censor at New York.—*T. and T. Age.*

Japan.—The number of telephone instruments installed in Tokio is 45,000. The number of persons who have applied for installations is now 60,000. The authorities are of the opinion that it will be possible to satisfy every one of these applicants within ten years!—*T. and T. Age.*

Leeds.—At 2 o'clock to-morrow, May 18th, the 7,000 telephones operated from the Leeds Central Telephone Exchange will be transferred to the automatic system. The preparations for this change have been in progress, with slight interruptions, since October, 1914, the alterations being under the supervision of Mr. T. B. Johnstone, the superintending engineer. The changing-over will constitute a record so far as the number of instruments is concerned, and the automatic system, when in full operation, will be the largest in this country. At the hour named, the series of pegs insulating the 7,000 wires will be pulled out in groups of 50, and it is expected that in about 30 seconds the operation will have been completed.

South Africa.—A complete breakdown of the Durban telephone system occurred on Easter Sunday. A high-tension wire is believed to have fallen across a telephone wire or wires, and caused great damage in the basement of the exchange. There are about 3,000 lines in the basement, the greater part, if not all, of which were partially destroyed. The necessary repairs will take about a month to effect, especially as the space in the basement of the exchange is so restricted that only a limited number of men are able to work there at one time. The trunk lines as well as the local lines and fire alarms are meanwhile all out of action.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—June 7th. Department of the Navy. Supply and erection of power plant at Garden Island, Sydney. Director of Navy Contracts, Melbourne.

Brisbane.—July 1st. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary, the Treasury, Brisbane.

Erith.—Electricity and Tramways Department. 500-kw. rotary converter with transformers, switchgear, &c. See "Official Notices" to-day.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

Manchester.—May 28th. Electricity Committee. Stores for 12 months. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Warrington.—May 22nd. Electricity and Tramways Committee. Motors and Transformers. See "Official Notices" May 3rd.

CLOSED.

Australia.—Sydney.—Water Supply & Sewerage Board. Steam turbines and condensers for Ryde-Pymble pumping plant:—

Willans & Robinson	(accepted)	£20,257
Fraser & Chalmers, Ltd.		19,335
W. Adams & Co., Ltd.		21,336
Belliss & Morcom, Ltd.		21,659
Brush Electrical Engineering Co., Ltd.		24,049
Gibson, Battle & Co., Ltd.		24,902

(Office estimate £16,000.)

—*Tenders.*

Belfast.—Corporation:—

General Electric Co.—Electrical accessories and M.F. lamps, 12 months.
B. I. & Helsby Cables, Ltd.—Copper fuse wires, C.I. box frames and covers, six months.
Staveley Coal & Iron Co.—Pipes, six months.
Chamberlain & Hookham.—Electricity meters, six months.—*Irish Builder.*

Bolton.—The Corporation has approved of the acceptance of the following tenders for supplies to March, 1919:—

Morgan Crucible Co.—Carbon brushes.
G. P. Wall.—20's steel binding wire.
Northern Rubber Co.—India-rubber channel.
W. N. Birchby.—Coal and slack to December 31st, 1918.
R. Young & Co.—Grease, &c. (3 months).
Universal Wheel Grinding Co.—Emery wheels.

Electricity Committee:—

B. I. & Helsby Cables, Ltd.—Cables and insulated wire.
General Electric Co.—Jointing material, tape, and solution, and 15,000 ft. of casing and cover.
Credenda Conduits Co.—Steel conduits and fittings (3 months' supply).

Bradford.—Electricity Committee:—

Chloride Electrical Storage Co., Ltd.—Maintenance of an electric vehicle battery.
B. I. & Helsby Cables, Ltd.—Increase of 10 per cent. on existing schedule prices for cables.
Herbert Morris, Ltd.—5-ton overhead travelling crane.
J. Blakeborough & Sons, Ltd.—Circulating water valves.

Kettering.—Electricity Committee. Tenders recommended:—

New parts to air pump.—Rees Roturbo Co., £46.
Installation of new circulating water pipes.—Brush Electrical Engineering Co., Ltd., £425.

Wolverhampton.—Electricity Committee. Accepted tenders:—

Mellowes & Co.—Roof glazing for new boiler house, £266.
J. Hopkinson & Co.—Valves.
Premier Cooler Co.—Cooling towers, £4,565.
E. & S. Ham.—Cooling-tower foundations, £950; brick retaining wall in connection with switchboard extension, £100.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Saturday, May 18th. At 3.15 p.m. Visit to the works of the Tottenham District Light & Heat Power Co.
Friday, May 31st. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "The Heating of Industrial Buildings," by Mr. R. Rankin.

Institution of Electrical Engineers.—Thursday, May 23rd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Some Transient Phenomena in Electrical Supply Systems," by Prof. E. W. Marchant.

NOTES.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending May 26th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Darley Bentley.

Next for Duty.—Capt. E. G. Fleming.

Monday, May 20th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Dress, Marching Order, with rifles. Mid-day rations and tea rations to be carried.

Tuesday, May 21st.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 22nd.—No. 1 Company, Drill, Knotting and Lashing, 6.30—8.30. Recruits' Drill, 6.30.

Thursday, May 23rd.—No. 2 Company, Drill, Knotting and Lashing, 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30, Ambulance Section, 6.30—8.30. Band Practice, 7.

Friday, May 24th.—Musketry for the whole Corps, 5.30—8.30.

Saturday, May 25th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill, 2.45—4.45.

(By order) Macleod Yearsley, *Capt. and Adjutant.*

Decimal Coinage.—The Federation of British Industries by a unanimous resolution of its Executive Council has now given its support to the Decimal Coinage Bill which is before the House of Lords. The L.C.C. Education Committee has also resolved to support the Bill.

Electrical Power Engineers' Association.—The Midland Section held a smoking concert on Friday last, and an enjoyable evening was spent by a large and representative gathering. The chairman, Mr. R. A. Chattock, the city electrical engineer of Birmingham, addressed the meeting, and spoke of the need for organisation among the engineers of the electrical industry. He hoped that all present would do everything in their power to make known this Association, of which he was a member, wherever possible. In speaking of the objects of the Association, he said that primarily they desired to improve the status of their members, and to better their positions, particularly with regard to the younger ones. Employers of trained engineers would have to realise that they must pay for the goods. He referred to the widespread nature of the movement, and the danger in case of duplication of organisations, of losing importance in the eyes of employers. The I.E.E. was interested in the present trend of affairs, and, with similar objects to themselves in view, desired to co-ordinate the efforts of all electrical engineers.

Electrolytic Recovery of Tin.—Speaking recently to the Salvage Club, Mr. David Currie, Director-General of National Salvage, said the electrolytic recovery of tin from stannate solutions was, perhaps, the most economical process to adopt at the present time, especially owing to the simplicity of the plant required, and also in view of the fact that the materials and solutions required could be readily obtained. In this process the scrap tin, after cleansing, to remove grease, &c., is charged into suitable containers and immersed in a hot caustic soda solution. Cathodes consisting of iron or copper plates are arranged in the vicinity of the containers, on which the tin is deposited in spongy form; the deposit is removed from time to time and reduced to metallic tin in a special furnace. A plant of this type, requiring about 20 KW. working continuously, is found capable of dealing with about 15 tons of scrap per week, and recovering about 3 cwt. of tin of 98 per cent. purity.—*The Engineer.*

Water-Power Development in Canada.—The Special Joint Water-Power Committee of the U.S. House of Representatives held another hearing on the so-called "Administration" Bill on April 15th, with Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, as the speaker.

Sir Adam Beck delivered an exhaustive analysis from his own point of view of conditions relating to water-power development in the Dominion, and the sale of hydro-electric energy in Ontario as compared with what he knew of conditions in the United States, dealing in detail with the situation at Niagara Falls. He delivered a strong plea for monopoly in public utilities. He presented a number of figures tending to show that under Government control in Toronto the rate for electricity was about half the rate at Buffalo, and made other comparisons between rates in the United States and in Ontario.

At the present time, he said, that body had contracts with 225 municipalities. They paid all interest charges at 4 per cent. and a sinking fund of 1·8 per cent., which retired in 30 years. They paid all charges of depreciation, operation, administration, &c. The chairman continued:—

"We operate at the present time 12 systems. They will become interconnected eventually and form one great system. In this way we are attaining the object of the whole scheme—namely, that there should be one control only. We want to create a real monopoly, because we believe all these service undertakings should be a monopoly. There is little satisfaction in having competition in a telephone system, or a telegraph system, or even a railway system, and certainly not in an electric system in any community. The obnoxious poles and wires, the great dual cost of everything, and the great dual investment that results because of the diversity created by these various corporations covering the same field are undesirable from every standpoint."

As to the Niagara situation, Sir Adam said the principle laid down by the International Waterways Commission was that there should be an equal division of water for power purposes on all international streams. He presented figures to show that the total power now being generated on both sides of Niagara was 653,000 H.P. Of this amount, 265,000 H.P. was generated in the United States, which also received 110,000 H.P. exported from the Canadian side, making a total of 375,000 H.P. available in the United States. This amounted to 40 per cent. more for the United States than for Canada, although the latter country generated 100,000 more horsepower than was generated in the United States. Canada was now short about 100,000 H.P. of the amount that country needed, and in order to permit a continuance of the export, Canada had arranged to do away with all sign lighting, window lighting, and other uses of energy which were not essential. The power generated by the Province of Ontario had reduced coal consumption between 5,000,000 tons and 6,000,000 tons per annum.

The estimated potential horse-power of hydro-electric energy in Canada is about 50,000,000, and in Ontario alone about 5,000,000 or 6,000,000, with but 700,000 developed. At the beginning of the Commission's work in 1910, only 750 H.P. was being delivered to the twelve municipalities interested. The Commission has acquired up to date about 86 Corporations through friendly negotiation.

Fatalities.—An inquest was held last Friday into the death of G. H. Aspinall, aged 22, of Stockport. Aspinall was a machine tool maker, employed by Messrs. Hans Renold, Ltd., of Burnage, Manchester, and on the previous Wednesday he was seen to put his hand to the starting box of a motor and then to fall. He was unconscious, and, though everything was done for him at the firm's ambulance room, he died soon afterwards. It was then discovered that the box was "alive," and that the cause of this was a tiny piece of steel which had got there accidentally, and had produced contact by touching one of the live terminals. It was explained that when the current was on the iron box the starter would become a powerful magnet that would attract the piece of steel, which had probably danced about until it got into contact with the live terminal, and so made the whole box alive. Evidence was given that the cause of death was heart disease. As electric shock left no sign, the doctor could not say if the man had received a shock; but if there had been a shock—as there probably was—it would have accelerated death. The jury returned a verdict of "Accidental death," and the Deputy-Coroner expressed the opinion that no one was to blame. The firm had carried out all the Government Regulations. Only a fortnight previously the box was examined, and H.M. Factory Inspector for Manchester (Mr. W. H. Seal) joined with him in the opinion that the plant at the works was of the best.

Electric Furnaces.—According to the *Engineer*, figures given recently by Sir Robert Hadfield show that the average actual units of electricity required per ton of steel melted are 782. This figure is based on a total of 31,850 tons of steel melted.

Plant Growth Under Artificial Light.—Some experiments made by Dr. C. P. Steinmetz and Mr. J. L. R. Hayden, about Christmas, 1916, on the hastening of plant growth by artificial illumination, described in the *General Electric Review*, March, 1918, are hardly encouraging for ordinary conditions. Five gas-filled Mazda lamps of 500 watts were suspended 36 in. above the ground, 17 in. apart, over a bed 5 ft. × 9 ft. The five lamps were kept burning day and night for 44 days, after which two lamps were kept on for 29 more days. The power consumed was first 2·5 KW., which averages 55 watts per sq. ft., and corresponds to an illumination of 700 lumens per sq. ft. of ground; the temperature of the hothouse, about 18° or 20° C., was raised 2° C. by the lamps. Henderson's dwarf wax-bush beans were the plants selected for the experiment. In a small check-plot, a box 36 in. square, the beans received only day light. The rate of development was nearly doubled by the artificial light and heat, but it cost a great deal to approach direct sunlight effects, as was done in this case. Some plants, flowers, and fruit, it is pointed out, temporarily command very high prices during the winter; artificial light is commercially used already for such purposes, of course.

The Cardiff B.A. Meeting.—Though the Cardiff meeting (1918) of the British Association for the Advancement of Science has been cancelled, the general officers hope that annual members and others will maintain their subscriptions this year, so that it may not be necessary to curtail, for lack of funds, the research work of many Committees. Some of the work is stated to be of the greatest importance in connection with circumstances arising out of the war. Subscriptions should be addressed to Prof. Perry, the General Treasurer, Burlington House, W. 1.

Cooling Cable Ducts.—Where cables are laid in ducts artificial cooling is possible, and in an article in the *Electrical World*, of April 20th, by W. Keating and C. H. Mueller, particulars are given of experiments with air-cooling on a section comprising ten ducts, about a mile in length, which contain eight three-phase, 11,000-volt cables, No. 0000 gauge, each carrying 200 to 220 amps. during peak loads. Above a temperature of 150° F. (65·6° C.), dielectric hysteresis causes very rapid heating which quickly leads to breakdown, and in the summer of 1916 there were 38 failures in the section referred to. The temperature of the cables approached 130° F. By installing air blowers at alternate manholes, the air escaping at the intermediate manholes, the temperature of the cables was reduced to an average of 96° F. (35·6° C.), which is just within the safe limit. Only two breakdowns, both due to station failures at other parts of the system, have occurred on this section since the blowers were installed.

In general, the authors say, 35,000 K.V.A. is the maximum load any duct line should be called upon to carry, and it is at points on the Pittsburg system, where this value has been exceeded, that trouble has developed.

Engineering Progress in England.—Observations upon engineering progress in Great Britain during the war were the theme of a recent informal address by Mr. H. M. Hobart, of the General Electric Co., U.S.A., at a luncheon of the Boston Section of the American Institute of Electrical Engineers, following the speaker's return from abroad. He said the British electrical industry had been split up into many more divisions than in America, and the greater portion of the small firms had aspired to manufacture many different kinds of things. Prior to the war the electrical industry in Britain was at a low ebb. Many firms found their salvation in substituting munitions and other war work for electrical machinery.

The general convulsion had brought about a serious spirit of investigation which was leading to a complete change of policy. Many new associations of manufacturers had sprung into existence, and a policy of seeking to avoid destructive competition was much in evidence.

Commenting on the national electricity supply scheme, Mr. Hobart said:—"The prevalent temper of the British is comparable to a sort of great awakening, and I venture to predict that something of this sort, or, at any rate, something thoroughly equivalent in bigness and boldness, will be 'pulled off.'"

He was much impressed with the rapid progress lately made in England in the use of built-up ironclad switchgear as contrasted with the panel and cell systems used in America. Signs were appearing of its competition with American outfits for high-voltage work in generating stations. Although the British had finally and reluctantly taken down the sign: "Business as usual," which they took pride in displaying during the early stages of the war, an enormous amount of engineering progress was being made in Britain even in these darkest of dark days.

The Metric System.—Speaking on "The Metric System," at a meeting of the Surveyors' Institution, Lieut. A. J. Martin, F.S.I., said that for upwards of half a century we had been abandoning or altering nearly all the measures and weights of our forefathers. In these days, and more so in the coming days, we must have up-to-date weapons of commerce or lose to an up-to-date Power, or collection of Powers, who had already made the change and gained ground ever since. Opponents of the international metric system had for many years combined against it; but no one yet, although repeatedly challenged, had produced complete tables which surpassed the international and should replace our own. Consequently, therefore, the only alternative to remaining as we were was to adopt that system. There could, in his opinion, be no hesitation as to which course was preferable. The war presented a favourable opportunity for the change, which would otherwise become more and more difficult every year, and might come too late. A great responsibility, therefore, rested upon them at the present time. Should they have two distinct systems of measures and weights in force? Or should they take steps to maintain and improve their position and the unity of the Empire, and even to advance the federation of mankind by adopting one language in commerce?

An interesting discussion ensued, and one of the speakers was Mr. E. C. Barton, M.I.E.E., who said that they were continually being told that the difficulties were so great that they could not overcome them; he thought that was a very unfortunate attitude for a great nation to take. There was not such a large majority of opponents of this proposal as one would think. A plebiscite by the ELECTRICAL REVIEW showed that 80 per cent. were in favour of it. He had paid a visit to the North, and was surprised at the number of engineers in favour of adopting the metric system.

The President (Mr. A. L. Ryde) said he could not imagine anyone arguing that the metric system was not better than anything they had at present, and it was a mere question, to his mind, whether, and how, it could be carried out. It must be done sooner or later; they could not compete with other nations unless they did it.

A neat and handy set of conversion tables for British and metric weights has been issued by the Hoffmann Manufacturing Co., Ltd., of Chelmsford—a companion to the linear conversion table which the firm issued some years ago. By the use of red and black figures and letters for metric and British units respectively, with one exception—evidently a slight oversight—the possibility of error is greatly reduced, and the tables are set out in a very convenient form. Copies may be had on application to the company.

The Education Bill.—The Executive Council of the Federation of British Industries has passed a resolution to the effect that, having regard to the apparent misconception existing in regard to the attitude of the Federation of British Industries on the Education Bill, the Council places on record its full sympathy with the objects at which the Bill aims—namely, the improvement and extension of education in this country—and will give all possible support in attaining these objects. It believes, however, that these objects cannot be attained in the fullest degree unless due provision is made for a full-time secondary education for the largest possible number of children. But before enacting any system of universal part-time education, time should be afforded to enable the employers and employed to give consideration to any peculiar needs or difficulties of particular industries and districts.

Training Disabled Men.—West Ham Corporation has made arrangements to hold a day course in electrical engineering for disabled sailors and soldiers. The Minister of Pensions has informed the War Pensions Committee that if the Higher Education Sub-Committee is of opinion that the expenses incurred will necessitate a fee in excess of 7s. 6d. per man per week, which is the amount normally sanctioned, he is prepared to defray out-of-pocket expenses specially incurred by the Local Education Authority during the period of six months. No special class for disabled men is to be started for less than five men, and every endeavour should be made to bring the number of men up to at least 10, which the Minister regards as the normal number of men for a class. The expenses chargeable against the Ministry are to include only out-of-pocket expenses specially incurred for the purpose of these classes—*e.g.*, extra teachers' salaries and extra cost of raw material.

The borough electrical engineer has arranged to release Mr. L. W. Perryman, a member of his staff, for six months, in order to take charge of this course; and the Education Committee has appointed him as a teacher for the period of the course—viz., six months—at a salary of £300 per annum.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. Bluemel Bros., Ltd., to avoid or suspend Patent No. 26,436/07 granted to Bosch for sparking plugs.

Output of Large American Generating Systems.—Statistics for 1917 on the outputs, peak loads, and load factors of the largest generating systems of the country are given in the *Electrical World*, Vol. 71, No. 12. The list contains every generating company in the United States and Canada having an output of more than 100,000,000 KW.-hr. per annum. The aggregate output of the companies listed was 21,000,000,000 KW.-hr., of which the companies operating in Canada generated 3,500,000,000 KW.-hr. Although the greater part of the electrical energy was generated from water power, almost all of the hydro-electric systems having steam reserve stations were obliged to use them during the year. The shortage of hydro-electric energy at Niagara is well indicated by the large output that the Buffalo General Electric Co. was called upon to turn out in its steam-driven station, where approximately 130,000,000 KW.-hr. had to be generated from coal.

Only one company in the entire list shows a slight decline in output over that of the previous year. All the others show increases, and all the Canadian companies show large increases, due chiefly to the great demand made for power by war industries.

OUTPUT AND LOAD FACTOR OF GENERATING SYSTEMS IN AMERICA WITH PEAK LOADS OVER 100,000 KW.

System.	1917.			
	Peak load (KW.)	Date of peak load.	Yearly output (KW.-hr.)	Yearly load factor (per cent.)
Commonwealth Edison Co.	392,330	Dec. 28	1,488,080,000	44·6
Niagara Falls Power Co.* .. .	152,340	Aug. 1	1,188,221,770	88·97
Ontario Power Co. of Niagara Falls	123,500	Nov. 11	990,086,100	91·5
New York Edison Co. and United Electric Light and Power Co. ..	278,097	Dec. 12	954,913,584	39·2
Montana Power Co.	147,712	Jan. 11	947,732,014	73
Montreal Light, Heat and Power Co.	152,665	Nov. 12	946,892,817	70·8
Hydraulic Power Co.	113,665	June 9	871,563,138	87·6
Pacific Gas and Electric Co.	158,272	Nov. 27	854,099,030	61·6
Toronto Power Co.	118,000	Dec. 14	800,638,000	84
Southern California Edison Co. ..	166,755	Oct. 11	794,687,405	54·4
Public Service Electric Co.	181,500	Nov. 27	734,665,649	46·20
Detroit Edison Co.	152,300	Nov. 27	672,200,600	50·4
Shawinigan Water and Power Co. ..	119,000	Dec. 21	633,573,610	60·4
Philadelphia Electric Co.	148,931	Nov. 20	600,583,589	46·0
Duquesne Light Co.	125,000	Nov. 9	592,575,925	54
Cleveland Electric Illuminating Co.	113,228	Nov. 27	444,735,309	45

* Includes Canadian Niagara Falls Power Co.

The World's Largest Turbine.—The electrification of the coast section of the Chicago, Milwaukee & St. Paul Railway took a long step forward recently with the turning-over for the first time of its big turbo-generator, the largest in the world. The turbine is of 25,000-H.P. capacity, and constitutes the third unit in the White River plant, the largest and most important of the hydro-electric plants of the Puget Sound Traction, Light and Power Co. The water is fed to the turbines at a head of 465 ft. The first two turbines are of 20,000 H.P. each. The total capacity of the plant with the added unit is 65,000 H.P. This gives the traction company a combined capacity of all its plants supplying Seattle of 110,000 H.P.

The Milwaukee Road will require a little more than 50 per cent. of the additional power. The current will be delivered to the railroad at a voltage of 100,000 alternating, and transformed into direct current at a voltage of 3,000, for use on the motors of the Milwaukee electric locomotives.—*Power*, April 23rd, 1918.

Electro-metallurgy in Sweden.—The future and progress of electro-metallurgy in the north of Sweden are reviewed by B. Neuman in *Stahl und Eisen*, who says the industry will derive great benefit from the water powers of the country. The ores are reduced in electric furnaces, and it is estimated that the cost of an installation comprising four furnaces of 9,000 KW., is something like 1,600,000 kroner, including 400,000 kroner for housing the workmen. The annual smelting of 30,000 tons of ore necessitates the employment of 81 men, and the price of producing 1,000 kgm. of metal is between 71 and 74 kroner, the electrical energy consumed costing between 13 and 18 kroner. Transporting the metal to the interior markets costs between 78 and 79 kroner, but the price of metal smelted in blast furnaces was before the war between 70 and 75 kroner. The development of the electro-metallurgical industry in the north of Sweden is not possible until the price of the electrical energy used is lowered.—*Genie Civil*.

London Underground Railways and Welfare Work.—On Wednesday, last week, a Women's Club and Institute was opened by Lady Stanley at Brompton Road Station, for the female booking-office and uniform staffs of the Underground Railways. Recreation and refreshment rooms are provided, as well as a reading and rest room, and a concert hall of considerable size. The rooms are tastefully decorated, and refreshments are supplied at cost. Over 30 other institutes and mess-rooms have been provided for the service of the railway and omnibus staffs.

Restriction upon the Use of Lead-covered Cables.—We have received the following letter on this subject from Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A. :—

"Your issue of April 19th contains a letter by Mr. Llewellyn B. Atkinson, the secretary of the Cable-Makers' Association, drawing attention to a misunderstanding that has arisen *re* the above matter.

"The notice appearing in your issue of March 8th being certainly open to the possibility of misinterpretation, due to the abbreviated reference to the opinions of the Cable-Makers' Association and the I.M.E.A. Council respectively, I have pleasure in confirming that the contents of Mr. Atkinson's letter are in accordance with the communication originally made by the Cable-Makers' Association to my Association, and communicated *in extenso* to our members."

Electric Welding in the Building of Ships.—In August, 1917, Prof. Comfort A. Adams, chairman of the Standards Committee of the American Institute of Electrical Engineers, appointed a Sub-Committee to investigate the possibilities of electric welding in shipbuilding.

This Sub-Committee was adopted in September last by the General Engineering Committee of the Council of National Defence, and later (February 21st of this year) by the Emergency Fleet Corporation, as its Electric Welding Committee.

The Emergency Fleet Corporation has authorised the construction of a 50-ft. (15.2-m.) section of a 9,600-ton standard ship at the yards of the Federal Shipbuilding Co., Newark, for demonstration purposes and for the development of methods of applying electric welding to an actual ship structure. This ship section is to be sealed up at the ends, filled with water, and tested by hydrostatic pressure. The foundation for this structure is already complete, and work will be pushed on as rapidly as possible. Both spot and arc welding are to be employed. Shipbuilders have indicated that they are willing to push the work just as far as the Classification Societies, the Fleet Corporation, and the Navy Department will allow.

Large stationary and portable spot welders are being designed for this work, and various arc-welding systems are being studied. A considerable installation will be made in the Hog Island yard at Philadelphia, under the general direction of Admiral Bowles, of the Fleet Corporation.

Mr. H. M. Hobart, chairman of the original Sub-Committee, spent several months in England investigating the electric welding work done by the British Admiralty, and brought back some valuable data. As a result of this visit, Captain James Caldwell, R.E., representing the British Admiralty, is spending a couple of months here to help the Committee in this work and to tell of the work along similar lines which has been carried out in England. One important phase of the present work of the Committee is the training of arc welders, of whom thousands will probably be required in the comparatively near future.—*Electrical World.*

Electrical Men Aid Prisoners of War.—In view of recent events on the Western Front, few of the funds being raised in connection with the war have a more urgent claim upon our attention and practical generosity than those existing for the purposes of sending parcels to our men who are prisoners in the hands of the enemy. The first large effort that has been made by electrical men to aid such funds has been made by the Bristol and Cardiff electrical and engineering trades. The effort has been crowned with splendid success, and we regret that war-time pressure upon our limited space prevents us from giving the event that full publicity which it deserves. The crowning effort in connection with the scheme, which was to raise funds for our prisoners of war (through the Bristol Red Cross Society) and the Bristol Inquiry Bureau, took place last Saturday evening. With Mr. H. I. Rogers as president, a Committee, combining all the influential electrical men in Bristol, founded a scheme by which it has raised about £600 for the funds. On the previous evening (Friday) a whist drive and a dance were held at the Grand Hotel, and both were successful, thanks to Mr. A. C. Wiley (chairman of the Committee), Mr. Weeks, Mr. Glass, Mr. Porter, Mr. Hood, and Mr. Pedlar, who formed the Special Committee for this particular scheme. The prizes were presented by Mr. Dowson, Mr. A. Davis (Morgan Crucible Co.), Mr. W. J. Longhurst (Veritys, Ltd.), and Mr. W. G. Heath. On the following day, on the Bristol City Football Ground, two excellent teams, selected by the Bristol and Cardiff Committees, played a football match before a crowd of 8,000 spectators, in glorious weather. The Bristol boys won by 2 goals to 1.

The city ground was kindly lent for the occasion by the directors, and their chairman (Mr. Murdock) rendered valuable assistance. Mr. W. J. Wedlock captained the Bristol team. Players from Everton, Birmingham, Wolverhampton, and Barnsley being in the vicinity of Bristol, volunteered their services, and the Cardiff team included T. J. Hewitt, the Welsh international, as "skipper." The band of the Royal Engineers was there. The Lord Mayor of Bristol, together with the Lady Mayoress, the High Sheriff and the Lady Sheriff, patronised the match, and the ball (presented by Messrs. Harris's Sports Department), was set rolling by the Lord Mayor. At half-time the Lord Mayor sold the ball by auction twice, and the sum of £23 2s. was realised. The ball has since been again re-sold for 10 guineas. A barrel of cider, kindly presented by Mr. J. H. Winter, was put up for auction at the dinner after the match, and sold by the Lord Mayor for 37 guineas. Mr. W. J. Longhurst, as the knight of the whistle, refereed the game in a very able manner. The linesmen were two G.E.C. men, Mr. A. H. Smith (Cardiff) and Mr. W. L. Richards (Bristol). Much of the success of the scheme is due to a Committee of ladies from the Bristol Corporation and electrical houses, with Mrs. Cyril Nutt as chairwoman and Miss Michell as secretary. The following chairmen acted over various Sub-Committees :—Mr. Longhurst, Mr. Weeks, Mr. Dowson, Mr. Royce; and Mr. A. J. Newman (Bristol Corporation) superintended the gate stewards at the ground. Mr. A. C. Wiley acted as chairman of the various Committees. Mr. A. H. Dowson presented cigarettes for the wounded soldiers who were present, and was the hon. treasurer of the movement. Mr. Ernest Cooke (Simplex Conduits) was the hon. secretary.

Appointments Vacant.—Electric lighting attendant, for oil-driven generating station in the Curragh District; junior shift engineer (£156), for the Barnsley Corporation Electricity Department; teacher of day classes in electric wiremen's work, for the Wolverhampton Education Committee; assistant shift engineer (68s. 3d.) for the Bury Corporation Electricity Department; meter superintendent for the Loughborough Corporation Electricity Department; charge engineer for the Dover Corporation Electricity Department. See our advertisement pages to-day.

Large Single-Phase Transformers.—Four of the largest single-phase transformers ever built were recently shipped by the Westinghouse Electric and Manufacturing Co. to a Southern power company. These units are rated at 14,000 K.V.A., 60 cycles, and, since they have a 25 per cent. overload rating, they have practically a 17,500-K.V.A. maximum capacity. They will form a 42,000-K.V.A. bank, which, together with a spare unit, will make the preliminary installation to step up the voltage of the water-wheel-driven generators from 13,200 to 150,000, the highest transmission voltage used to-day. Power will be transmitted about 25 miles to an industrial plant, where it will be stepped down by means of a number of 7,000-K.V.A. single-phase transformers of similar characteristics built by the Westinghouse Co.

Some idea of the size of these units may be gained from the fact that their height measures 23 ft. 6 in. from the top of the high-tension terminals to the base, and each unit weighs, complete with oil and fittings, approximately 110,000 lb.—*Power*, April 23rd, 1918.

Track Construction Methods Employed in Street Widening.—In the *Electric Railway Journal* of March 30th, an account is given of the methods employed in track construction during the widening of Twelfth Street, one of the principal thoroughfares of Chicago. The taking up of two well-laid tracks set in concrete construction, moving them more than 20 ft., and placing one of them along what was formerly the front end of a store basement, was the part taken by the Chicago Surface Lines Co.

The street was widened from 66 ft. to 108 ft., and the work involved the building anew of 1·38 miles of double track, including seven special work lay-outs, and the rebuilding of 300 ft. of double track on either side of the street at each one of these seven intersections, on account of the change in grade. In all, over 3 miles of single track was built in a short space of time, and a number of labour-saving devices were employed, as the paving contractors were working under a time penalty clause.

The foundation for the concrete slab for the east-bound track was first laid and completed all the way through before the old tracks were disturbed. East-bound traffic was then operated over the new track, leaving the former east-bound track free for the use of work and material cars. As the sub-grade construction work for the new west-bound tracks progressed the rails of the old east-bound track were moved, in good condition, over on to the new ties and foundation. Finally, upon the completion of the second track, west-bound car service was transferred to this, and the old west-bound track was torn up and removed.

The type of track construction used is the standard 2—A Board of Supervising Engineers' Construction for use in paved streets, except in some cases, where it differs on account of the uncertain character of the foundation, placed as it was over a new fill some 9 ft. deep.

When the new east-bound track was completed for traffic work was commenced on the new west-bound track, and this is interesting because of the fact that the rails of the old east-bound track were moved over and used on the new track without separating the electrically-welded joints. All work on the sub-foundation was, therefore, completed for a section, and gangs of men following the mixers freed the rails of the old track from their fastenings, and they were then pried over. This was done by gangs of men using crowbars to gradually pry the rail over to its new position, this being done quite satisfactorily without breaking any of the Lorain-welded joints. When the rail was in its new location, another gang of men cleaned the rail to receive the new concrete and grouting.

The work of tearing up the old paving outside the rails in order to free the rails was greatly expedited by placing jacks underneath two or three tie rods at a time, after the inside paving had been removed. Lifting up on the jacks bent the rods up and pulled the rails towards each other and away from the outside paving, thus avoiding the necessity of removing the first row or two of blocks by hand.

Institution of Electrical Engineers.—At the meeting of the Institution, on Thursday last week, the President, Mr. Wordingham, announced that the Council, in conjunction with the B.E.A.M.A., had appointed a Committee on the lines suggested by Mr. W. A. Gillott, to deal with the subject of electric cooking and heating. Similar action had been taken as the outcome of Mr. L. Andrews's paper, in association with the B.E.A.M.A., the C.M.A., Chambers of Commerce, the Federation of British Industries, and the British Engineers' Association, with a view to calling a conference to discuss whether any action could be taken that was likely to further export trade. A Committee had also been appointed, as suggested by Mr. E. C. McKinnon, to draw up a model agreement for the maintenance of storage batteries, and the Council was communicating with the British Engineering Standards Committee with regard to the standardisation of the details of batteries. An Electrical Appointments Board was in course of formation: under the Articles of Association this could not be done by the Institution, but a separate body would be set up for that express purpose, acting in conjunction with the Institution.

Breach of Lighting Regulations.—At York, last week, Major P. Davidson, R.F.C., was fined £1—the Bench considering a technical offence had been committed—for causing electrical energy to be consumed in the auditorium of the Albany Hall, Goodramgate, during prohibited hours, the occasion being a dance in aid of the local Red Cross funds. The light was being used half an hour later than was permitted by the Board of Trade licence.

Metal Commandeering in the States.—A Reuter's dispatch states that the U.S. Government has commandeered all the platinum, palladium, and iridium held by refiners, jewellers, dealers, and some importers at a price of $105 per troy ounce.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—MR. GEORGE A. NEWSOME, A.M.I.C.E., manager of the Burgh and County Tramways, Dumbarton, has been appointed manager of the Darwen Corporation Tramways.

The municipal electrical engineer at Durban (Mr. John Roberts) has, for health reasons, tendered his resignation to the Corporation. Mr. Roberts has held the position for the last 20 years.

Plymouth Electricity Committee has increased the salary of the engineer (MR. E. G. OKELL) by £50 per annum (£650 to £700).

The Dartford U.D.C. has increased the salary of MR. J. D. PEMBER, electrical engineer, from £310 to £350 a year.

MR. CHUBB, assistant engineer at the Maidenhead electricity works, has resigned to take up an appointment at Stoke-on-Trent.

The Torquay T.C. has advanced the salary of MR. KEENAN, acting electrical engineer, from £180 a year to £230, plus the special bonus of £63 per annum, Mr. Keenan foregoing the 12½ per cent. award under the Munitions of War Act, 1916.

The proposed increases of salaries in the Bradford tramway department, subject to payment for any work by officials for Government or other authorities being made to the Corporation, are as follows, including bonus:—

Mr. C. J. Spencer, general manager, increase £200, to £1,000; Mr. J. W. Dawson, electrical engineering assistant, by £50 to £375: Mr. T. Stirk, traffic superintendent, by £50 to £350; Mr. W. K. Fleming, parcel department superintendent, by £40 to £298; Mr. T. B. Moseley, chief clerk, by £25 to £298; Mr. T. Sykes, technical assistant, by 22s. 2d. to 114s. 8d. per week; Mr. S. Pearson, works superintendent, by 19s. 3d. to 114s. 8d.; Mr. J. W. Foster, permanent-way engineer, by £30 per annum to £300; Mr. H. S. Sharp, assistant engineers' department, by 2s. per week to 72s. 6d.

At the Swansea Corporation electricity department, on Friday last, MR. B. BEYNON, charge engineer, was presented with a clock and ornaments, on the occasion of his marriage. The presentation was made by the borough electrical engineer (Mr. J. W. Burr).

MR. P. PRIESTLEY, manager of the Oldham Corporation tramways, who was recently appointed deputy manager of the Liverpool Corporation tramways, was presented, last week, with a cabinet of cutlery from the employés of the Oldham tramway department.

General.—MAJOR ARTHUR WATSON, who has been superintendent of the line on the Lancashire and Yorkshire Railway for several years, is now appointed also assistant general manager.

The *Times* states that it has been decided by the Congress of the General Association of French Posts and Telegraphs that M. PREVOST should represent the Association at the British Postal and Telegraphic Congress to be held next month.

The staff of the General Electric Co., Ltd. (Glasgow Branch) met, last Friday evening, to celebrate the semi-jubilee of MR. P. J. SIMS, manager for Scotland. A most successful concert was held in the handsome new building of the firm at 71, Waterloo Street, just completed since the outbreak of war. The presentation—which took the form of an 18-carat gold watch and a mahogany clock with a sapphire, pearl, and diamond pendant for Mrs. Sims—was made by Mr. A. G. Bell, a member of the staff, who has been associated with Mr. Sims almost since the beginning of his connection with the firm. Mr. Jas. Wink, manager of the Aberdeen sub-branch, acted as chairman, and was supported by representatives from the English branches and leading engineering and manufacturing firms in the country.

Roll of Honour.—The Military Medal has been awarded to SERGEANT A. WOOLLEY, of Stone (an employé of Messrs. Siemens Bros. Dynamo Works, Stafford), for gallantry in action. When his battery was subjected to a hurricane bombardment he showed an utter disregard for personal safety. On another occasion he worked assiduously in helping to extinguish an ammunition dump fire.

PRIVATE FRED FALLOWS, L.N.L. Regiment, who was employed at a Bolton Corporation electricity sub-station, has been killed in action, aged 19 years.

PRIVATE GEORGE MACDONALD, who was engaged on the Burnley Corporation tramways, has been awarded the Military Medal.

PRIVATE E. BRADBURY, Duke of Wellington's Regiment, wounded in action, was employed at the Bradford Corporation electricity works.

PRIVATE T. WHITAKER, Northumberland Fusiliers, who has been awarded the Belgian Croix de Guerre, was formerly on the staff of the Leeds City Electricity Department.

FLIGHT-COMMANDER CAPTAIN E. D. HALL, R.A.F., who has been awarded the French Croix de Guerre, was electrical engineer at Brandon Collieries when he joined the Forces.

PRIVATE H. S. HOLDSWORTH, Manchester Regiment, posted missing in September last, and now reported killed, was employed by Messrs. Charles Macintosh, Ltd., Manchester.

RIFLEMAN H. WILSON, K.R.R., reported missing since March 24th, was on the Coventry Corporation electricity department staff.

SERGEANT-MAJOR STANLEY PARKER, K.O. Yorkshire L.I., who was an electrician at Ackton Hall Colliery, Featherstone, has been killed in action.

LANCE-CORPORAL A. G. SCOTT, who was on the staff of the Ilford U.D.C. electricity works, has fallen in action.

GUNNER C. R. LIDDELL, R.F.A., who was before the war a draughtsman with Messrs. Cowans, Sheldon & Co., of Carlisle, has been killed whilst repairing a telephone line near the position of his battery.

RIFLEMAN J. ROSE, Royal Irish Rifles, who has been missing since March 21st, was employed by Messrs. John Collier & Sons, electricians, of Manchester.

LANCE-CORPORAL F. GIFFORD, R.E., who has died of wounds, was employed by Mr. Jabez Smith, electrical engineer, of Faversham.

LANCE-CORPORAL C. F. BAKES, West Riding Regiment, who is reported missing since March 21st, was employed by the Phœnix Dynamo Manufacturing Co., Ltd.

CAPT. G. L. ANDREWS, R.G.A., whose death in action is reported, qualified, according to a Sheffield paper, as an electrical engineer at the Brush Co.'s Works, Loughborough, and afterwards held positions under the tramway authorities of Kidderminster, Madrid, Hull, Sunderland, and Lisbon, and as manager of the Para Electric Railways and Lighting Co. and of the Pernambuco Tramways and Power Co. He was a member of the Institutions of Civil, Mechanical, and Electrical Engineers.

SECOND LIEUT. W. PARR-DUDLEY, who was killed in action on April 5th (aged 19), went to Faraday House Electrical Engineering College two years ago with a scholarship, and, according to the *Times*, he won the Silver Medal there at the end of his first year. He joined the Forces in May last year.

SECOND LIEUT. E. F. S. HAYTER, R.F.A., who was killed in action on March 21st (aged 26), was born in Australia, and was educated in Melbourne as an electrical engineer. He was connected with the electrical signalling work of the Victoria State Railways until he came to England, two years ago, to join the Forces.

ACTING-SERGEANT WM. GEIPEL was killed on May 4th at the Curragh, Ireland, while flying. Only on the morning of the same day he was recommended for a commission in the R.A.F., being recognised as a "pilot far above the average," and possessing the qualifications of leadership and command essential for an officer. The deceased was a nephew of Mr. Wm. Guy-Pell (Wm. Geipel and Co.). Previous to joining the Forces he was a student at the Armstrong College, Newcastle, and was an apprentice electrical engineer at Messrs. Richardsons, Westgarth's works at Hartlepool.

RIFLEMAN C. H. LONG, K.R.R., an apprentice at the Chichester electricity works, was killed in France, aged 18 years.

PRIVATE W. H. GREEN, Somerset Light Infantry, who is posted missing, was employed by the St. Helens Cable and Rubber Co.

CORPORAL E. LESLIE, S. Lancashire Regiment, who has been killed in an explosion on the railway, was employed in the electricity department of the Warrington Corporation.

PRIVATE T. WHITAKER, who was formerly employed at the Whitehall Road works of the Leeds Electricity Department, has been awarded the Belgian Croix de Guerre.

PRIVATE J. FOSTER, who has been wounded in action, was formerly employed at the Kirkstall Road depôt of the Leeds Corporation tramways.

Obituary. MR. CHARLES S. GARNETT, manager of the Darwen Corporation electricity works, died from pneumonia on Sunday morning aged 40 years. He had only been ill a week.

MR. CHARLES CYRUS HOWARD, formerly tramway manager for the Bolton Corporation, has died at the age of 70 years. He retired from active service in 1906, and had been ill for some years past.

The *Times* "Deaths" column contains notification that there passed away on May 11th, at Cleveland, Ohio, after protracted illness, CHARLES SKRINE POWELL, who was on the staff of the Westinghouse Co. in London from 1902 till 1905.

NEW COMPANIES REGISTERED.

Electrical Components, Ltd. (150,218).—Private company. Registered April 20th. Capital, £5,000 in £1 shares. Manufacturers of and dealers in electrical accessories, motor-car fittings, &c. The subscribers (each with one share) are:—W. T. Bower, 184, Jockey Road, Sutton Coldfield, electrical engineer; R. W. Bill, 19, Whitehall Road, Handsworth, electrical engineer. The first directors are: W. T. Bower (manager and secretary) and R. W. Bill. Registered office: 36, Cannon Street, Birmingham.

Tampico Electric Light and Power and Traction, Ltd.—Particulars of £500,000 debenture stock created December 27th, 1917, secured by trust deed dated April 16th, 1918, filed pursuant to Section 93 (3) on the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Benefit of concessions and contracts for undertakings connected with Tampico, Mexico, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Major the Hon. Weetman H. M. Pearson, and Sir Maurice Bonham Carter, K.C.B.

Associated Brass and Copper Manufacturers of Great Britain, Ltd. (150,375).—Private company. Registered May 7th. Capital, £50,000 in £1 shares. Manufacturers and factors of copper, brass, metals, and alloys, and plant, fittings, and articles manufactured wholly or partly therefrom, and to acquire any existing business or rights in connection therewith, provided that (until the restriction is relaxed by extraordinary resolution) the business to be established, acquired, or carried on by the company shall be limited to soliciting and obtaining orders from and export to China (including the Republic of China, Hong-Kong, and any parts of China proper which have passed, or may pass, into the possession of any other Power). The subscribers (each with one share) are:—Sir Gerald A. Muntz, Bart., Tiddington House, Stratford-on-Avon; E. C. Clark, Norwood, Ellesmere Park, Eccles, metal manufacturer. The first directors are: C. J. R. Bedford, Birmingham; E. C. Clark, Manchester; J. W. Earle, Birmingham; K. Fraser, Leeds; W. W. Gibbins, Birmingham; E. Mapplebeck, Birmingham; Sir Gerald A. Muntz, Bart., Birmingham; and A. W. Wolseley, Birmingham. Qualification, 500 shares, or being a director or nominee of a company holding that number of shares. Remuneration as fixed by the company. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

Alloy Welding Process, Ltd. (150,396).—Private company. Registered May 9th. Capital, £120,000 in £1 shares (20,000 cum. pref.). To enter into agreements (1) with the Russo-British Finance Co., Ltd., and (2) with E. J. Jones, to acquire certain inventions relating to improvements in electric blow-pipe and other forms of welding and soldering, and to carry on the business of engineers, manufacturers of and dealers in motor cycles, &c. The subscribers (each with one share) are:—W. H. Mugford, 1, Strathearn Road, S.W. 19, solicitor's clerk; C. H. Brookes, 3, Worcester Gardens, S.W. 11, solicitor's clerk. The first directors are: E. H. Jones (managing director), W. A. Hunter, and F. W. Poyner. Remuneration according to profits. Solicitors: Spyer & Sons, Austin Friars House, E.C. 2.

Quain Electric Co., Ltd. (150,401).—Private company. Registered May 9th. Capital, £20,000 in 10,000 cum. pref. and 10,000 ord. shares of £1 each. To enter into an agreement with the Russo-British Finance Co., Ltd., to acquire certain patents relating to improvements in electric heaters and radiators, and to carry on the business of electricians and electrical engineers, &c. The subscribers (each with one share) are:—W. H. Mugford, 1, Strathearn Road, S.W. 19, solicitor's clerk; C. H. Brookes, 3, Worcester Gardens, S.W. 11, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitors: Spyer & Sons, Austin Friars House, E.C.

Batteries, Ltd. (150,403).—Private company. Registered May 10th. Capital, £100,000 in £1 shares. To acquire from the Svenska Ackumulator Aktiebolaget Jungner (incorporated in Sweden) all or any part of its patent and similar rights, &c., for the United Kingdom and British Empire in relation to the manufacture of storage batteries or other apparatus, &c. The subscribers (each with one share) are:—W. L. W. Brodie, 4, Regent Street, S.W., solicitor; W. H. Bonham-Carter, 4, Regent Street, S.W., solicitor; P. J. Dobinson, 4, Regent Street, S.W., clerk; W. T. C. Bennett, 4, Regent Street, S.W., clerk. The first directors are: W. L. W. Brodie and W. H. Bonham-Carter. Registered office: 19, Coleman Street, E.C.

Phœnix Armature Works, Ltd. (150,299).—Private company. Registered April 27th. Capital, £2,000 in £1 shares. To take over the business of armature winders and repairers carried on by H. A. Parkes at 455A, Stockport Road, Manchester, as the Phœnix Armature Works, also to carry on the business of repairers and renewers of the windings of electrical generators, motors, and machinery, &c. The subscribers (each with one share) are:—H. A. Parkes, 72, Stockport Road, Manchester, mechanic; W. L. Worledge, 62, Wellington Road, Oldham, electrical engineer; E. King, 19, Lucerne Avenue, Werneth, Oldham, electrical engineer. The first directors are: H. A. Parkes, W. L. Worledge, and E. King. Qualification, £100. Solicitors: Howard, Laycock & Co., 33, Princess Street, Manchester.

Parkinson Motors, Ltd. (150,330).—Private company. Registered May 1st. Capital, £25,000 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers of and dealers in dynamos, motors, machines, meters, lamps, burners, wire, and accumulators, and all articles and implements used for supplying light and power. The subscribers (each with one share) are:—F. Parkinson, Greenlaw, Guiseley, engineer; A. Parkinson, 2, Eldor Mount, Guiseley, engineer. The first directors are: F. Parkinson and A. Parkinson (both permanent). Solicitor: G. C. Thompson, 5, Bank Street, Bradford.

J. H. Nott & Sons, Ltd. (150,365).—Private company. Registered May 4th. Capital, £10,000 in £1 shares (3,000 pref. and 7,000 ord.). To acquire the business formerly carried on by the late John Henry Nott as J. H. Nott & Sons, at Vincent Lodge, Swansea, and elsewhere, and to carry on the business of lighting, heating, sanitary, mechanical, electrical, and general engineers, plumbers, electricians, ironfounders, manufacturers of and dealers in gas engines, motor cars, &c. The subscribers (each with one share) are:—G. Nott, Overton, Glanmon Road, Swansea, electrical engineer; W. D. Hughes, 70, Sketty Road, Swansea, secretary to Swansea Hospital. The first directors are: G. Nott and W. D. Hughes. Solicitor: E. Davies, 4, Goat Street, Swansea.

Wigan Electro-Metallurgical Works, Ltd. (150,320).—Private company. Registered April 30th. Capital, £50,000 in £1 shares. To acquire from W. B. Hamilton, H. A. Blackwell, and W. L. Turner their interests in an invention relating to grey cast iron, and to carry on the business of ironmasters, manufacturers of pig iron, white iron, grey iron, and electro pig iron from scrap or ore, steel makers and converters, manufacturers of metallic alloys, &c. The subscribers (each with one share) are:—H. A. Blackwell, Whyte House, Bispham, Blackpool, metal merchant and mine owner; W. L. Turner, Purley, Caldey, Ches., company director; W. B. Hamilton, 32, Grosvenor Road, Birkdale, metallurgical chemist; A. W. Blackwell, Sparlands, Argyle Road, Southport, metal merchant; Geo. G. Blackwell and Sons, Ltd., 46, The Albany, Liverpool; Blackwell's Metallurgical Works, Ltd., 46, The Albany, Liverpool; British Thermit Co., Ltd., 49-51, The Albany, Liverpool; E. S. Blackwell, Rossett, Bankfield Lane, Southport, metal merchant. The first directors are: H. A. Blackwell and W. L. Turner (governing directors), each of whom may retain office while holding 15,000 shares. Qualification of ordinary directors, 500 shares.

J. E. & S. Spencer, Ltd. (150,316).—Private company. Capital, £10,000 in £1 shares. To take over the business carried on at 16, Dowgate Hill, E.C., as J. E. & S. Spencer, and to carry on the business of iron merchants, engineers, metal agents, metal-tube manufacturers, electricians, &c. Agreement with S. Spencer, Sir Ernest Spencer, H. Spencer Smallman, and T. H. Spencer. The subscribers (each with one share) are:—S. Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; Sir Ernest Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; T. H. Spencer, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent; H. Spencer Smallman, 16, Dowgate Hill, E.C., tube manufacturer, merchant, and agent. The first directors are: S. Spencer, Sir Ernest Spencer, T. H. Spencer, and H. Spencer Smallman. Qualification, 1,000 shares. Registered office: 16, Dowgate Hill, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aluminium Corporation, Ltd.—Three mortgages dated April 15th, 1918, to secure £500, £575, and £1,100, charged on lands in Carnarvon. Holders: (*a*) R. S. Chamberlain and Lucy G. Chamberlain, (*b*) W. M. Jones and R. V. Johnson, (*c*) Mary and Ellen Davies.

Brazil, Straker & Co., Ltd.—Temporary charge on the company's undertaking and property, present and future, including uncalled capital, dated April 13th, 1918, to secure £25,000 already advanced, and further advances up to £50,000. Holder: F. C. Yeo.

Worthington Pump and Machinery Corporation (1,659F).—Particulars filed April 24th, 1918. Registered in Virginia, U.S.A., April 20th, 1916. Objects: To acquire certain properties formerly owned by the International Steam Pump Co. (incorporated in New Jersey), and to carry on the business of mechanical, electrical, and general engineers, &c. Capital stock, 36,000,000 dols. in shares of 100 dols. each. British address: Queen's House, Kingsway, W.C., where E. W. Husted is authorised to accept service.

Manganese Bronze and Brass Co., Ltd.—Memorandum of satisfaction in full on March 25th, 1918, of charge dated December 1st, 1917, to secure £6,500, has been filed.

Mica and Micanite Supplies, Ltd.—Mortgage dated April 17th, 1918, to secure £1,400, charged on leasehold premises at Islington. Holder: A. G. Weeden.

Brilliant Arc Lamp & Engineering Co., Ltd.—Memorandum of satisfaction in full (*a*) on May 14th, 1917, of charge dated May 28th, 1917, securing fluctuating amount, and (*b*) on February 7th, 1918, of charge dated April 26th, 1917, securing fluctuating amount.

Baxendale Bros., Ltd.—Third debenture, dated January 16th, 1918, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. P. Vine, Bath.

A. Vernon-Ward (Hove), Ltd.—Notice of the appointment of A. Rosenberg, of 259, High Holborn, W.C., as receiver and manager on April 25th, 1918, under powers contained in debenture dated March 20th, 1918, filed pursuant to Section 94 of the Companies (Consolidation) Act, 1908.

Maxim Lamp Works, Ltd.—Agreement to issue debentures, charged on certain leaseholds and trust deed for £4,000, dated March 21st, 1918. Debentures to be charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. F. Poynter.

Robert Bowran & Co., Ltd.—Mortgage for £2,000, dated May 1st, 1918, charged on freehold land and buildings at Pelaw, Durham. Holder: J. Blaney, Sunderland.

Acousticons, Ltd.—J. P. Clarkson, of 16-17, Devonshire Square, E.C.; ceased to act as receiver or manager on April 30th, 1918.

Hill Bros. (Magnetos), Ltd.—Equitable charge on properties at Bedminster, Bristol, to secure all moneys due or to become due from company to National Provincial & Union Bank of England.

Burgess Hill & District Electric Supply Co., Ltd. (85,698).—Capital £6,000 in £1 shares (3,000 pref.). Return dated March 19th, 1918. All shares taken up. £5,900 paid; £100 considered as paid. Mortgages and charges: £1,200.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—Capital, £200,000 in 99,990 pref. and 100,010 ord. shares of £1 each. Return dated March 28th, 1918. All shares taken up. £1 per share called up on 50,010 ord. and 99,990 pref, and 8s. per share on 50,000 ord.; £170,000 paid; £30,000 considered as paid, being 12s. per share on 50,000 ord. Mortgages and charges: £50,000.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—Capital, £425,000 in £1 shares. Return dated March 26th, 1918. 400,000 shares taken up. £400,000 paid. Mortgages and charges: £250,000.

CITY NOTES.

Babcock and Wilcox, Ltd. Net profit for 1917, subject to excess profits duty, £444,513, plus £56,495 brought forward. After paying the preference dividends and 9 per cent. on the ordinary shares, free of income-tax, £150,000 is put to reserve fund, £10,000 to the staff pensions fund, and £77,056 remains to be carried forward, subject to excess profits duty. The works are fully occupied to the extent of the labour available.' The total holding in War Loan and Bonds is £928,945. Paying the ordinary dividend free of income tax is equivalent to an increase in yield. Owing to the machinery being operated by unskilled labour, and the impossibility, due to the shortage of skilled labour, of keeping it in the usual state of repair, it has been considered necessary to provide for the exceptional wear and tear of same. In the Sociedad Espanola de Construcciones Babcock & Wilcox which has been formed, this company has a considerable interest, and it will be under the company's technical management. Two directors—Messrs. Knight and Kemnal—have been appointed directors of the Spanish company. This new enterprise has been approved by the British authorities. The whole of the capital of 20 million pesetas has been subscribed in Spain and by this company. Mr. F. G. Bourne has retired from the board. In his place Mr. E. H. Wells, president of the Babcock & Wilcox Co., New York, has been elected a director.

The French Thomson-Houston Co.

It was recently mentioned in this journal that the Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston had decided to increase its share capital in two stages from £2,400,000 to £3,600,000 and £4,800,000 respectively. The reasons which have led to this development were explained in a special report presented at a recent extraordinary general meeting, and in the course of a speech delivered by the chairman on that occasion, which is of interest beyond the borders of France, M. Charles Laurent stated that the directors had endeavoured to develop the company's means of production in the course of recent years; they had extended the works and improved the machinery and plant, and had recruited a numerous personnel not only to repair the large gaps which the mobilisation had caused in the ranks, but also to improve the efficiency. Since May, 1916, the company had made a large issue of bonds in order to satisfy the growing requirements, and had acquired in the vicinity of Paris a vast site for the erection of workshops. But all this was inadequate for the purpose. It was necessary to proceed further if it was desired not only to conserve for the company the important position which it occupies in the electrical industry, but also to render it able to participate in the intense business activity which was expected as soon as Europe or the whole world returned to a peaceful life, and at the same time permit it victoriously to contend with foreign competition. It was possible to use two methods for the accomplishment of this object. The first was for the company to continue with its individual resources the expansive effort which had been commenced, and the second was to ascertain whether it was not possible to unite with a similar undertaking which all at once could furnish all the new forces desired. Although the difficulties which would have attended the execution of the former plan would have been considerable under existing conditions, the directors doubtless would have been induced to propose it had not a favourable opportunity presented itself for attaining the object in view by means of an understanding with the directors of an undertaking with which they had not ceased to maintain friendly relations, namely, the Eclairage Electrique. Certain of the manufactures produced by the latter, the chairman remarked, were similar to those made by the Thomson-Houston Co., whilst others were complementary thereto. The Compagnie Francaise Thomson-Houston was to absorb the Eclairage Electrique by the issue to the latter of new shares in the former for nominally £1,200,000, and the Eclairage Electrique would be liquidated for this purpose. The works would be taken over in full activity with the staff of experienced men, a numerous body of customers, and the personal cooperation of the directors, to whom the rapid rise of that company was due. The principle of the amalgamation having once been agreed to, the chairman stated that a second augmentation of £1,200,000 in the share capital was a natural corollary, as a developing undertaking needed a considerably larger working capital for the supply of the workshops and for current working requirements. The existing proprietors would have a preferential right of subscription to the second issue of £1,200,000, and the new shares would be available for a period extending three months after the conclusion of Peace, so as to allow those who under present circumstances might be unable to take up the shares for various reasons, a future opportunity of exercising their right in this direction.

German Companies.

The directors of the *Lloyd Dynamo werke A.G., of Bremen*, state that after allocating £11,000 to depreciation in 1917, as against £6,500 in the previous year, the accounts show net profits of £7,300, as compared with £2,400. It is proposed to distribute 7 per cent., this contrasting with no dividend in 1916.

The financial statement of the *Nord-Deutsche Seekabel Werke A.G., of Nordenham*, whose share capital of £300,000 is jointly held by the Felten & Guilleaume Co. and the German Atlantic Telegraph Co., indicates net profits of £14,000 for 1917, as against £1,400 in 1916, the sum of £9,000 and £8,000 respectively having previously been written off for depreciation. A dividend of 4 per cent. is recommended, being the same rate as in 1916.

The accounts of the *Elektrochemische Werke, of Berlin*, whose shares, amounting to £350,000, are entirely held by the Zurich Bank for Electrical Undertakings, show net profits of £109,000 for 1917, as compared with £73,000 in the previous year. It is intended to pay a dividend of 15 per cent., as against 12 per cent. in 1916. The company only carries on, apart from war installations, an oxalic acid factory, the main works at Bitterfeld and Rheinfelden being leased to the Griesheim Elektron Chemical Co.

The report of *Voigt & Haeffner A.G., of Frankfort-on-Main*, states that all departments were occupied to the limit of their capacity in 1917, and the value of the turnover more than doubled, the new factory rendering good services in this respect. As gross profits the accounts show the sum of £270,000, as compared with £169,000 in the preceding year. After defraying general expenses and setting aside £34,000 for depreciation, as contrasted with £14,000, the net profits are returned at £170,000, as against £102,000 in 1916. The directors recommend a dividend at the rate of 12 per cent. on the share capital of £250,000, being the same rate as in each of the two previous years. A bonus of £5 in War Loan and £1 10s. in cash per share are also to be distributed, making a total of 25 per cent. for the year. The report states that a reduction in the deliveries for war account may be reckoned with in the new financial year, but that favourable activity is foreseen for the company's regular manufactures.

The report of the *Bergmann Elektrizitats Werke A.G., of Berlin*, states that the works were increasingly engaged on war contracts in 1917, which necessitated the taking up of new manufactures. A substantial augmentation in the turnover took place, and about one-half of the volume of business applied to the delivery of munitions, and one-half to the company's regular products. The system of co-operation practised in connection with Government electrical works had already led to large orders, which were in course of execution. Special attention was devoted to the cultivation of trade with neutral countries in so far as this was permitted by the State, release of raw materials, and the grant of export licences. The gross profits amount to £1,079,000, as compared with £958,000 in 1916. After meeting general expenses, interest charges on the loans, taxes, &c., and placing £253,000 to depreciation, as against £316,000 in 1916, the accounts exhibit net profits of £573,000, as compared with £459,000. The dividend is at the rate of 12 per cent. on share capital of £2,387,000, this contrasting with 10 per cent. in 1916, 10 per cent. in 1915, and 5 per cent. each in 1914 and 1913.

The Swedish Elektra Works.—The directors of the A. B. Elektra Verken report net profits of £39,000 for 1917. After making provision for the renewals and reserve funds, they recommend the payment of a dividend of 10 per cent. on the ordinary share capital of £164,000. In order to liquidate the debt of £660,000 shown in the balance sheet as being due to the Allmänna Svenska, of Vastoras, for the purchase of factories in the latter place for the production of cooking and heating apparatus and installation material, and in order to extend the company's activity, it is proposed to increase the share capital to £274,000. It is mentioned in this connection that soon after its formation the Svenska Elektra Verken acquired the Stockholm glow-lamp factory, the Svenska Elektra battery factory, and the Svenska Thermos flask factory, these acquisitions giving the company the majority control over the Tungsten Wire Works, A.B.

British Ever-Ready Co., Ltd.—The report to March, 1918, shows that the amount available for appropriation, after writing off depreciation, charging £2,500 to general reserve, and after making reserve for the purpose of providing for excess profits duties, income-tax, and contingencies, amounts to £34,683. Final dividends of 10 per cent. are paid on the preference and ordinary shares, making 10 per cent. for the year, plus a bonus of 7½ per cent. in the case of the ordinary shares, making their total 17½ per cent., leaving £6,058 to be carried forward. The directors are carefully considering the conditions that may be expected to prevail after the war, and what steps are necessary to place the company in a position to take the best advantage of those conditions.

France.—An extraordinary general meeting of the Compagnie des Cables Télégraphiques, held in Paris on April 30th, approved an increase in the share capital from £537,000 to £640,000, so as to permit the company to participate to the extent of £100,000 in the formation of the new company termed the Compagnie Générale de Télégraphie sans Fil. This decision has been taken in agreement with the Ministry of Commerce, who authorised the company temporarily to transfer the amount from the prevision fund pending repayment from the proceeds of the capital augmentation.

Western Union Telegraph Co.—The annual report shows that in 1917 the gross operating revenue was 77 million dollars, and operating expenses were 63 millions, leaving 14 millions surplus, making with 1½ millions for loans, &c., a total of 15½ millions. After deducting interest on bonds and amounts transferred to reserves, there remained a balance of 11¾ millions to be added to the surplus of 24¼ millions from 1916. Dividends absorbed 7 millions, leaving a surplus of 29 millions. The dividend was at the rate of 7 per cent.

Great Northern Telegraph Co., Ltd. (of Denmark).—At the general meeting to be held on June 29th, the directors will propose for the year 1917 the distribution of a total dividend and bonus of 22 per cent., including the 5 per cent. already paid, and to set aside the following amounts, viz.:—£55,556 to the reserve and renewal fund, £11,111 to the pension fund, and £111,111 to extraordinary taxes.

British Insulated & Helsby Cables, Ltd.—The scheme for reorganisation of the capital by capitalising £500,000 of the reserves, and issuing it in the form of ordinary shares fully paid, is to be submitted at an extraordinary general meeting on May 27th. Each ordinary shareholder will receive one share for every one now held by him.

Minehead Electric Supply Co., Ltd.—The war restrictions reduced the units sold for lighting during 1917, and there was a considerable increase in cost of fuel, in wages, and repairs. There was a satisfactory increase in units sold for power. Profit on trading, after paying debenture interest, £906, plus £31 brought forward. After paying the preference dividend, and 5 per cent., less tax, on the ordinary, £316 is put to depreciation and reserve, and £59 is carried forward.

Calcutta Electric Supply Corporation, Ltd.—Final dividend on ordinary shares for the half-year ended December 31st, 1917, 6½ per cent. actual, making 10 per cent. for the year.

Nairobi Electric Power & Lighting Co., Ltd.—Final dividend of 4 per cent., making 10 per cent. for the year, less income tax.

Craigpark Electric Cable Co., Ltd.—The annual meeting was held in Glasgow on Monday; Dr. Magnus Maclean presiding. The report was adopted.

Edison & Swan Electric Co., Ltd.—A petition for confirming the reduction of capital from £888,071 to £698,307 has been presented to the Court.

Anglo-Portuguese Telephone Co., Ltd.—Final dividend of 5 per cent., less tax, for 1917.

Chloride Electrical Storage Co., Ltd.—Dividend on ordinary shares 10 per cent., free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The confident tone of the Stock Exchange markets is well maintained. No news from the Front is read as good news—no news, that is to say, of the beginning of another German offensive. Domestic politics have quieted down, but the subscriptions to the National War Bonds are not regarded with satisfaction. At the same time, considerable uncertainty remains over financial matters generally, in consequence of the man-power proposals, and until something more definite emerges from the obscurity, so long is it bound to be the case that men of the new military age will conserve their assets in as liquid a form as possible, and make whatever arrangements they regard as necessary to meet the prospect of having to live upon capital if they are called up.

Prices in most markets are better. A noticeable recovery has taken place amongst home railway stocks, although the Undergrounds, as usual, are somewhat slow in responding to the lead set by steam stocks. The best market is that for Underground Electric issues, where London Electric ordinary have risen 15s. to 2½, and the Underground income bonds at 77 are 2 to the good. There has been vague talk of some re-arrangement being made in regard to the interest payable on the latter bonds, but nothing official has transpired, and in the market it is not considered likely that alterations will be made, at any rate for the present. The Tubes are likely to be benefited rather than the reverse from the drastic revision of fares now proposed. Judged by present conditions, there is more traffic than trains. To come up to town in a first-class smoking compartment with eight people sitting down and 26 standing up, while advertisement counsels the taking of a season-ticket "for comfort and room to breathe," should be more consoling to the proprietor of the company's bonds than to the traveller on the company's lines. District 6 per cent. debenture stock has risen to 101½, and the 4 per cent. debenture gained a point at 67½. Metropolitan Railway prior-charge stocks have strengthened, although the ordinary has eased off.

Mexican issues make a better showing. The various favourable factors to which attention has been drawn here during the past two months are combining to bring in a few bold purchasers. The railway stocks of the country are better, and Utilities, although showing few quotable changes, make a much better market than they have done of late. It looks as though prices might improve further, and that it would be wrong to sell now. British Columbia Electric stocks keep good, holding the full extent of the substantial rises which we recorded last week; the preferred and deferred show further advances. Anglo-Argentine Tramways 4 per cent. debenture has hardened to 69, and the 5 per cent. to 64, while the first preference are 1/16 better.

Tax-free stocks in the telegraph market keep steady. The Eastern group has hardened. Eastern ordinary is 3 up. Globes are not easy to buy. In other cable issues, the markets remain hard without showing noticeable changes. Marconis have stiffened, and with the parent shares has come improvement in one or two of the subsidiaries. Americans, for instance, are 23s. 6d., Canadians 9s. 9d., and Spanish changed hands the other day at 9s. Anglo-Portuguese Telephone ordinary were done at 18s. 3d. this week; the debenture stock has gone back a couple of points to 94½.

London Electric Supply preference have hardened to 3¼, and this constitutes the only change in the list of supply companies' shares. A good deal of activity stirs amongst the manufacturing descriptions. General Electric ordinary are a good market at 20¼ bid. Edisons have recovered to 32s. after their dip to 24s. Brush ordinary is quoted at the nominal price of 40 to 45, but there are buyers about at the top figure of 45, and they might even give more. British Westinghouse preference are conspicuously flat at 2 1/16 ex the 3s. dividend. The chairman's speech at the recent meeting has probably a good deal to do with the sales that have depressed the price, but it may be that too much pessimism has been read into his remarks. Electric Constructions are a better market at 23s. 9d. upwards. Babcock & Wilcox, in the engineering division, rallied to 3⅜ on the declaration of a final dividend making 15 per cent., free of tax, for the year. Henley's are 10s. higher at 19½.

London United Tramways debenture has weakened to 38. Tenders are being invited by the respective companies for London and Suburban "A" debenture, and Metropolitan Tramways 4½ per cent. debenture. A guide to stockholders who may desire to tender is afforded by the market quotations, which are 77-80 for the London and Suburban, and 69-72 for the Metropolitan stocks. Business has revived to some extent in Victoria Falls & Power descriptions, the second debentures rising to 107, the ordinary and preference being 18s. and 23s respectively. Rubber shares continue to show a weak tendency. Iron and steel issues are firmer. Base-metal shares are mostly on the up-grade.

SHARE LIST OF ELECTRICAL COMPANIES

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price May 14, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6¾	—	£7 8 0
Charing Cross Ordinary ..	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	5	8	—	8 6 8
City of London	8	8	12	—	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10½	—	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	6⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	+ ⅛	7 13 10
Metropolitan	3	4	3¼	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94	+ ½	6 7 8
do. Def.	88/6	1½	22¼	—	6 14 10
Chile Telephone	8	8	7½	+ ⅛	5 6 8
Cuba Sub. Ord.	5	7	9¾xd	—	*7 7 4
Eastern Extension	8	8	15xd	—	*5 6 8
Eastern Tel. Ord.	8	8	153½xd	+3	*5 4 8
Globe Tel. and T. Ord.	7	7	14⅜	—	*4 17 5
do. Pref. ..	6	6	9⅞	+ ⅛	6 1 6
Great Northern Tel.	22	24	36½	—	6 11 6
Indo-European	18	19	48¾xd	—	6 14 0
Marconi	10	16	3¼	—	4 17 10
Oriental Telephone Ord. ..	10	10	4¼	—	2 7 0
United R. Plate Tel.	8	8	7	—	*5 15 4
West India and Pan.	6d.	6d.	1¼	—	*8 6 8
Western Telegraph	7	8	15⅜	—	*5 4 1
Home Rails.					
Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	20¾	—	4 16 5
do. District	Nil	Nil	14	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A" ..	Nil	Nil	4/6	—	Nil
do. do. Income	6	4	77	+2	*5 4 0

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	2 13/16	+ 1/16	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	64	+1	7 16 4
Brazil Tractions	4	4	43	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	58½	—	8 11 0
do. do. Preferred	Nil	Nil	40½	+2	Nil
do. do. Deferred	Nil	Nil	34	+1	Nil
do. do. Deb.	4½	4½	63	—	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	80	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	26½	—	Nil
do. 1st Bonds ..	Nil	Nil	38½	−2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	+ 1/16	4 8 8
British Aluminium Ord. ..	7	10	1 7/32	—	6 8 0
British Insulated Ord.	17½	20	8⅜	—	5 10 4
British Westinghouse Pref. ..	7½	7½	2 1/16xd	— 1/16	7 5 3
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	8 3/32	— 1/32	5 17 4
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6
Electric Construction	7½	7½	1 3/16	+ 1/16	6 6 4
Gen. Elec. Pref.	6	6	10¼	—	5 15 8
do. Ord.	10	10	20¼	—	4 18 9
Henley	25	25	19½	—	6 6 7
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15⅝	—	*6 8 0
Telegraph Con.	20	20	42	—	*5 18 0

* Dividends paid free of income-tax.

DIESEL ENGINES AND TAR OIL.

At a meeting of the Diesel Engine Users' Association held on March 21st, Mr. J. E. Edgecombe read notes on tar-oil running with a four-cycle, four-cylinder, horizontal, 400-b.h.p. engine driving a 20-ton flywheel-type alternator, with an output of 270 kw. at 2,100 volts, single-phase. In a 120-hour run the tar oil used was 6 tons 11 cwt., ignition oil 9 cwt., percentage of ignition oil to tar oil, 6.87 per cent., and units generated 14,771. The consumption figure of combined tar oil and ignition oil worked out at 1.07 lb. per unit generated. Crude petroleum was used mostly for ignition oil, but kerosene had given satisfactory results. Average blast pressure was 750 lb., at no time rising to 800 lb. Gas oil had been used for ignition purposes, and it was found equally as satisfactory as either crude oil or kerosene. It was his practice to change over to fuel oil before shutting down, and also to start up on fuel oil. On one occasion the engine was shut down on tar oil, and no difficulty was experienced in starting up again on tar oil. When overhauled the flame plates and pulverisers on all four lines were found in excellent condition, and showed no traces of choking up.

Mr. J. M. Ferguson said the various devices were in their experimental stage, and at the present time pilot ignition formed the only reliable arrangement, and one which gave a greater latitude in the quantity of tar oil which might be used satisfactorily. The case for pilot ignition had not been quite fairly stated, for no mention was made that *tar oil* might be used for ignition purposes down to about half-load, thereby reducing the quantity of crude oil required to a much lower figure, depending on load conditions. A further point which required attention was the improvement which resulted from warming the tar oil.

Mr. H. S. Russell said the chief point put up against the ignition pump system was that a larger proportion of petroleum oil was required than with other systems. The only answer to this must be that the system had proved satisfactory wherever it had been adopted, and sufficient experience of the other systems had not been obtained to say that they solved the problem. Insurance companies were unwilling to take increased risks of breakdown, especially at the present time, and their objection to experimenting with systems which could not be said to have proved satisfactory could be understood. The various means by which engines could be adapted to tar-oil running without the use of ignition pumps all seemed to be objectionable from the point of view of the risk to the engine.

Mr. G. Neville Huntley, referring to ignition temperatures, said it was important to distinguish between the temperature of explosive ignition given by Mr. Moore's apparatus and the ordinary temperature at which oil caught fire at the surface when heated in an open cup. There was no necessary relation between the ordinary ignition point and the figures given by Mr. Moore's apparatus.

Mr. P. A. Holliday, after giving particulars of experiments which led up to the adoption of pilot-ignition, briefly described the gear as now fitted to a four-cylinder, 220-b.h.p. Diesel engine of their own build. Two fuel cam noses are fitted side by side, one for giving the valve "pilot injection," and the other being the main admission cam. Two independent rollers are fitted into the fuel-valve operating levers, the one engaging with the main cam being mounted on a concentric pin, whilst the other is mounted on an eccentric portion of the same pin. These pins are linked up to a main shaft connected to the governor, so that the clearance between the pilot cam and its roller varies according to the load on the engine; thus for full load it has the maximum, and for no load the minimum clearance. By this arrangement the fuel valve opening by the pilot cam is earliest on light load, and gradually becomes later until maximum load is reached. It is, therefore, possible to work with a good advance for no-load, and all the maximum pressures are reasonable. When starting or stopping on petroleum the gear is fixed, so that the engine only operates off the main fuel cam. The gear is very sure in its action, as shown by cards taken with the gear in and also out of operation. No pistons have ever been drawn, the exhaust valves remain normal, and the pulverisers, which are of usual standard design, do not require cleaning under 200 hours' run. Cooling water temperatures and blast pressures are normal.

Mr. C. O. Milton mentioned the peculiar behaviour of a four-cylinder, 320 b.h.p. Corlis engine fitted only with coned flame plates, and the original pulverisers of the ordinary type. This engine would run without any trouble down to one-tenth of full load, while generally engines would not run steadily on tar-oil at less than half-load without the provision of more elaborate devices. It was found practicable to cut out a cylinder without upsetting the regular running of the engine. It was most important to note that a cylinder should never be cut in or out while the engine was on tar oil. It should first be put over on to fuel oil, the change in the number of working cylinders then made, after which it could be put back on to tar oil. He found that outside certain limits a difference in temperature of the cooling water of 15 deg. would make an appreciable difference to the running of an engine. An engine required very much closer attention when running on tar oil; even fuel distribution was much more important than with petroleum fuel. At Maidenhead needle valves kept tight and gave no trouble, but they were the despair of everybody connected with them. An examination showed that the points of opening of the fuel valves were much earlier than usual, and this, together with the fact that the needles had worn down a recess into their seats, practically produced the same results as the new gear Mr. Holliday had described was intended to do. All sorts of difficulties seemed to be due mainly to variation, without any notice, in the quality of the oil supplied. The most important factor in the final solution of tar-oil running would be suitable and close specification of the oil.

Mr. H. Moore said that after tests with some 40 tar oils he had come to the conclusion that the entire problem of ignition trouble was one of temperature, and, apart from the use of ignition gear, it was therefore mainly dependent on compression. The main difference between petroleum oils and tar oils was one of ignition point. Ignition temperatures of petroleum oils were generally below 300 deg. C., while in the case of tar oils they were in the region of 500 deg. C. He had tested samples of tar oils which had been specially prepared, and found them to possess ignition points below 350 deg. C. Vertical-retort tar oils were slightly lower in ignition point than horizontal-retort tar oils. In order to obtain good working and starting from "cold" on tar oils without ignition oil, and certainty of ignition with all tar oils, it was necessary to employ a compression pressure of 650 to 700 lb. per sq. in. This necessitated higher blast pressures and increased stresses to a very serious extent. With the above pressures the wear on exhaust valves was no greater than with petroleum oil, but uncertainty of ignition and increased stress were very detrimental to them. Pulveriser choking was generally encountered when burning oils rich in naphthalene, but it need not prove to be a serious trouble, and would be overcome by modification of pulveriser design. Most members appeared to have had little difficulty with mixing oils; he had, however, known many cases of deposition of a solid india-rubber-like substance as the result of mixing tar oils with petroleum.

Mr. P. H. Smith said the most vitally important requirement, irrespective of running conditions or system applied to burn tar oil, was the pre-heating of the oil to about 80 deg. F. and feeding it to the engine at about this temperature. Regarding the Controller's aim, it was of the utmost importance to convert as large a number of Diesel engines as possible to burn tar oil in the shortest possible time, and prospective users of tar oil would therefore be well advised at the moment not to insist on refinements unessential to their ordinary loading conditions. The loading range must be extended, and minor difficulties overcome in both the national and Diesel users' interests. He disagreed with the previous speaker that compression pressures of the order of 650 to 700 lb. were necessary to burn tar oil without pilot ignition. The average pressures employed for any system appeared to be between 450 and 500 lb.

Mr. G. B. Vickers said his firm were pinning their faith on obtaining the best possible atomisation of the fuel. The main idea to obtain this complete atomisation seemed to be to offer as many sharp edges as possible where the blast air could impinge on the tar oil, splitting it up, as it tended to coalesce in passing through the flame-plate orifice. He thought too much stress should not be laid on running engines satisfactorily down to no-load; it was not advisable to do so, and these were not normal conditions.

Mr. Ernest T. Williams said it was important that engines burning tar oil should run satisfactorily, even at the lowest load, as there were instances, where no storage battery was used, in which engines had to run for considerable periods on low loads. The subject appeared to be of such importance that a small grant to enable an expert to devote a portion of his time to the subject would appear to be desirable.

A BRITISH ELECTRICAL PROVING HOUSE.

At a meeting of the Institution of Electrical Engineers last week this subject was discussed. An abstract of the paper by Mr. C. Turnbull appeared in our last issue.

Mr. C. H. Wordingham, President, said he would make a few remarks before the discussion opened as to the attitude of the Council on this subject, and what he said would be on behalf of the Council of the I.E.E. as well as on his own. It was some 20 years ago that he first suggested a similar scheme himself, but nothing came of it; he again brought up the question about four years ago, when the war commenced. The first thing to be remembered was that if, as was suggested, a new body was set up it must not overlap or commence doing on its own what others had been and were doing already. The suggested proving house should carry out tests only, it should not cover research work; and, further, it should not formulate rules nor make specifications. When these were, as they could be, made by the competent authorities, then the work of the proving house would be to see that they were properly carried out. Such a body as suggested would have to be compact, and not spread over a wide area, so that it should not overlap other bodies who were doing, and were more competent to do, the same work. The work of the proving house would consist of testing and examining goods, and when such goods conformed to its requirements, attaching its hall-mark thereto. This hall-mark should be attached only to Imperial goods and articles, and it would prove that such goods were made within the Empire, and that they had attained a high standard. He used the word Imperial rather than British because he had been misunderstood lately when he used the word British; it had been thought that he meant England and Scotland only when he said British, whereas he really meant Imperial. As to the governing body of the suggested proving house, there should be a preponderance of commercial representatives on the board, makers would also be largely represented, but not to such an extent as the commercial element, and, of course, users would also be represented on it. The National Physical Laboratory was governed by the Royal Society; it had lately carried out a large amount of commercial work and tests, and an advisory council of commercial men had now been formed. He was convinced that the proving house should be an offshoot of the National Physical Laboratory, and subject to the latter's board of control. A sub-board could be formed to govern the proving house, on which there should be three representatives of the I.E.E., including the President, six from the B.E.A.M.A., two from the Cable Makers' Association, two from the I.M.E.A., two representing insurance, one shipping interests, &c., and this sub-board would be under the control of the governing body of the N.P.L.

Mr. H. H. Berry pointed out that in the U.S.A. they already had such an organisation as the proposed proving house. He referred to the National Board of Underwriters, which had established a code of its own, but this code went beyond the scope of the present paper. By this code they had in the U.S.A. not only fixed standards, but also types, and in Canada British goods were thrown out, not because they did not conform to the standards of the code; the goods were not faulty, but they were of a different type, and they were rejected on the score of interchangeability. This Board of Underwriters had taken most elaborate precautions respecting fire risks, but it did not consider life risks to the same extent. Goods that conformed to the requirements of this code were quite safe regarding fire risk, but many of them would not be tolerated by British engineers on account of the life risks they involved. Speaking from a manufacturer's point of view, he said that, apart from the financial standpoint, manufacturers would have a great deal to gain from, and they would welcome, such a proving house; they had suffered in the past from the lack of just such an institution. A proving house such as suggested would have to work in conjunction with the National Physical Laboratory.

Mr. Roger T. Smith agreed with what the President had said; apparently the author, as set forth in his paper, wished the proving house to overlap the N.P.L., and other such bodies which carried out research work, and, further, that it should teach the Engineering Standards Committee its work. He disagreed entirely with these views. With regard to duties, the proving house should carry out tests only, and the preparation of specifications should be left to the Engineering Standards Committee. Further, the drawing up of new and improved rules should be left to bodies competent to deal with the subject; these were not matters for the proving house. Research should also be left to bodies which were intended to carry out research, and the work of the proving house would consist of carrying out any tests which it was asked to carry out. The question of cables and rubber could not be dealt with by the proving house, this would have to be left to an entirely separate body.

Capt. Wm. P. Digby said that a great deal would be learned from the results obtained by the work of a proving house, which should only deal with Imperial products, and the hall-mark should only be affixed to such products, although foreign goods could be examined as well with a view to finding out if there was anything that could be learned from them. An important point was that each of our Colonies should be represented by a local man on the governing committee of the proving house. Such a representative would keep the committee informed as to local conditions and difficulties by correspondence, and he would furnish information as to what was really required in his own particular locality. Speaking on the requirements of the American code, he said that all goods should pass a life test; it was not much use if an article conformed to requirements for a time only, it must have a reasonably long life if it was to be of any value.

Mr. Charles P. Sparks said that, speaking as the chairman of the Wiring Rules Committee, he entirely agreed with and welcomed the views put forward by the President. In this country they had been working away for years, but there was weakness because there was always a missing link in the chain, and he thought this proposed proving house would prove to be that missing link. There were enormous financial difficulties in the way of the scheme as put forward in the paper. The National Physical Laboratory was already in existence, it was at hand, and could go right ahead at once if the views and suggestions put forward by the President were adopted; he looked upon these views as something definite and constructive.

Mr. Ashley said that, in a way, he was there to represent the Board of Trade, but he came mainly to learn something. The Board of Trade attached great importance to the questions of interchangeability and standardisation; it considered that the proposed proving house would considerably help British industries both at home and abroad. The hall-mark of such an institution would carry great weight, and would afford help to inexperienced purchasers, as they would then be sure that goods so stamped were reliable. The scheme should have very careful and detailed consideration; the I.E.E. and the Engineering Standards Committee should be represented on the governing body of the proving house; its hall-mark must be affixed to goods quite independently of trade advice, and it must be entirely free from private influence if it was to attain international importance.

Mr. A. R. Everest said that the difficulty of the manufacturer was to know what he had to do. There were so many rules and regulations in force at the present time that the manufacturer was quite at a loss as to which of these he must follow. He quite agreed with the President's suggestions; construction should be left to the Engineering Standards Committee, and methods of installation to the I.E.E. When these bodies had collected, co-ordinated and issued particulars, then the work of the national proving house would be to certify and see that the rules were correctly carried out.

Mr. W. R. Rawlings said that all contractors would welcome the propositions put forward by the President, and he hoped they would meet with better success than those made on similar lines by the President some years ago in Manchester. Such a scheme would be welcomed by contractors, and more so by the public. Fire insurance companies only considered fire risks, and municipal authorities did not care so long as they could sell sufficient energy. An important point was that a proving house must have power to enforce its requirements, otherwise it would find itself in the same position as the Wiring Rules Committee stood today. If it were possible to obtain Home Office enforcement of the wiring rules, then they would be an excellent set of rules.

Mr. Wm. R. Cooper said he was glad to hear that the I.E.E. Council did not favour the proving house overlapping the National Physical Laboratory, and also that it was not proposed that it should carry out research work. The question of materials did not matter so much, it was the finished article that was important, and this was the work for the proving house, to see that the finished article conformed to requirements. The life of an article could not be stated beforehand unless the conditions under which it was to work were definitely known. It was difficult to give guarantees to cables because the exact conditions under which they were to work could not be known, and he therefore did not think the proving house could deal with such things as cables.

Mr. C. le Maistre said that he personally agreed with the Council's proposal. It was difficult to certify large numbers of articles, and he recommended the Engineering Standards Committee's system of sanctioning the use of its brand as *prima facie* evidence that the article complied with the standards specified. The Committee was now incorporated, and owned the brand. It was bringing into existence a number of affiliated committees in 12 or 14 engineering centres abroad; the Canadian Committee was an extremely strong one, and so was that of the Indian Government. South Africa was another important centre. The Committees were being formed with the help of the new department of the Board of Trade and the Foreign Office, and would ultimately be of immense value to British Trade abroad.

Mr. H. W. Clothier said that the proving house would naturally be the body to find out the necessity for inventions as the result of meeting with troubles of all kinds, but it should not be the authority to study troubles as well as affixing the hall-mark on British productions. He was one of those who did not take a gloomy view of the amount of research work that had been done in this country in the past. The author pointed to the number of research establishments in the U.S.A.; here we had a large number of small works and the requisite amount of initiative, and we could do what the Americans had done. The proving house would be a means of co-operation; he thought British manufacturers were working well together at present, and they were beginning to cooperate. The proving house would be a commercial authority, and it must not, therefore, be controlled by a scientific body. The whole scheme depended largely on the co-operation of insurance companies.

Dr. Richard T. Glazebrook said he was glad to hear that the proving house was to be joined in some way with the N.P.L.; the proving house should not do the research work, but it must certainly be in direct contact with some institution which did carry out the research work. He thought that senior members of the control boards of both the N.P.L. and the proving house should be in contact, so that they could work together without overlapping; and, further, that foreign goods should be reported on by the proving house. A good illustration of how the N.P.L. worked was in connection with aviation. When something new was required aviators stated what they needed, and the N.P.L. was left to find out what could be done, and how.

Mr. G. Scott Ram said that the question of specifications would be one of the first difficulties, as there were no specifications made for such things as fuses, &c. He thought the proving house should test the design as well as the material of all articles. In recent times the use of composite materials was coming to the fore, and it was very desirable that such materials as these should be tested.

Mr. D. N. Dunlop said he was glad to see the I.E.E. was beginning to take interest in commercial matters; however, he would not say much on that question, as no doubt both sides were to blame for what had occurred in the past. With regard to the present scheme, he thought that co-operation would be easy enough, but who was going to finance the scheme? The Government would not pay, and in the U.S.A. they had a stamp system by which the money was eventually got out of the consumer. He thought that the proving house should at first commence with small articles, and gradually build up. He did not see why foreign goods should not be examined as well as British goods; there was no reason for not affixing the hall-mark to foreign goods providing they were examined, and had proved that they conformed to the requirements of the national proving house.

Mr. J. F. **Pearce** said that the principles advocated were generally conceded, and the association of the proving house with the National Physical Laboratory had one outstanding advantage—the independent position of the Laboratory. There were, however, disadvantages in this connection, which the speaker detailed, emphasising the importance of the maintenance of standards by the Laboratory, and urging that functions so different as those of the Laboratory and the proving house should be independently performed.

Mr. C. **Turnbull**, in reply, said that apparently most speakers were in favour of some such scheme as he suggested in his paper, Mr. Roger Smith being the only speaker who criticised it in any way. He hoped the scheme would be carefully thought over, and that the work of setting up such a proving house would be commenced with as little delay as possible.

ELECTRICAL COOKING AS APPLIED TO LARGE KITCHENS.

At a meeting of the **Manchester Local Section** of the **Institution of Electrical Engineers**, Mr. W. A. **Gillott**'s paper was read and discussed on December 11th, 1917.

Mr. **Bertram Thomas** said that if electrical cooking were generally adopted so as to affect station plant and the distribution of energy, the tariffs would have to be readjusted. In many cases the load came on the peak, and was not altogether a desirable load for a central station. Efficiency need never be sacrificed to reliability. Usually the trouble had been that the apparatus had not been well designed, and had been rated too high. Difficulty was now being experienced with supports; mica used as a support by itself was not very satisfactory, as it would not stand a high temperature. Most of the failures had been due to terminals, leading-in wires, or supports. He did not think there was really any reason why the wire itself should fail if it were properly rated. No large up-to-date kitchen could be established unless low-pressure steam was provided. It did not seem a practical proposition at the present time to use electricity for heating large quantities of water. The washing-up ought to be carried out in a separate department, and it was necessary to wash up by steam if it was to be done effectively. A motor-driven steam-heated washing machine was the only practical way. The author appeared to favour self-contained vessels, but it would be found that everybody wanted to use their own vessels, and did not wish to install new ones. Careful comparative tests indicated that as between gas and electric cooking there was very little difference in the loss of weight of meat; it was about 3 per cent. in favour of electricity. By the use of the thermometer, cooking could be made almost an exact science; that must lead to economy both in electricity and in food.

Mr. A. E. **Jepson** said that one of the speakers in the discussion* before the Institution suggested that more attention should be paid to high-voltage apparatus, say for 400 or 500 volts. There were difficulties in the way. The insulation of most of the insulators used, such as mica, enamel, and ceramic ware, decreased enormously as the temperature rose. He had known the insulation of a hot-plate to decrease from 40 megohms when cold to 1,000 ohms at 400 deg. C.; while a slab of quartz changed from 95 megohms at 486 deg. F. to 0.17 megohm at 1,013 deg. F. In order to make water-boiling a commercial proposition for large quantities, where the cost of generating electrical energy was low, say, 0.22d. to 0.28d., and if electrical power could be obtained for water-boiling at such a figure, with a properly lagged boiler having a low consumption there would be practically no heat lost; an extra heater could then soon bring the water up to boiling point when required. Station engineers might quote a special figure for units consumed during the night, when water-heating might be carried on. He endorsed Mr. Thomas's remarks about the economy of cooking by electricity.

Mr. R. **Weaving** was pleased to note that the author placed reliability first, as the absence of breakdown was more important than the consumption of a few more units. Most of the breakdowns in the past had been due to wiring faults and troubles between terminals and element wires. The large apparatus described in the paper could be designed to allow of strip connections not less than ⅝ in. wide being brought out direct to terminals on porcelain supports in the bottom of the oven. Wrought-iron clamps scaled badly with heat, and eventually became loose; cast-iron clamps should be machined. Troubles with mica were due to using the wrong kind of mica. Mica under pressure withstood a high temperature, but if it were loose it would lose its tenuity and fall to pieces. If it were clamped up tight it remained good. It was hardly worth while to lag for more than 1 in. thickness. Oven elements properly designed should have an average life of over three years. Where there was a supply of steam available it ought to be employed, but if it were necessary to generate steam specially, the question of capital cost must be considered. In a recent equipment, not only the water for tea, &c., but a supply of washing-up water, cooking water, and water for baths and wash-bowls was provided, all heated electrically.

Mr. H. A. **Ratcliff** said that the electrical heating of water was not a commercial proposition with electricity costing more than ½d. per unit. The specifications of the several equipments seemed to point very clearly to the passing of what might be called the "tin-box type" of cooker, but it almost appeared as if manufacturers were going to the other extreme. In the list of advantages of electric cooking he observed that there was no reference to hygienic considerations; he thought they constituted the chief advantages of electrical cooking apparatus; the ordinary naked-flame gas-oven was probably as unhygienic a device as it was possible to have. He was surprised that the author referred to the decreased loss of weight when meat was cooked electrically; if there was a saving it probably arose from a lack of ventilation. The cooking load was bound to clash with the power load, and in winter time there would necessarily be a considerable clashing of the suburban cooking and lighting loads, but as a rule the effect on the mains would be of more consequence than the effect on the generating stations.

Mr. H. **Allcock** had recently formed the opinion that the design of electrical cooking apparatus, especially that of boiling plates, was now in the critical stage when the working voltage was an all-important factor. Some plates he tried on a three-wire 250-volt × 250-volt system with the middle wire earthed had very short lives. One trouble appeared to be the development of hot spots, due either to faulty heat distribution or to the disintegration of the mica—in any case the heating element in the plate broke down to earth. In fish frying it was essential to bring the fat to a very high initial temperature, to plunge the fish into it, and to replace the loss of heat very rapidly. The electric fish fryer was handicapped because the rate of heating was less rapid than in the case of a gas-heated fryer. Reliability was much more essential than any other factor when designing an electrical kitchen.

Mr. H. R. **Burnett** said that in order to obtain a large consumer for electrical cooking they must be in a position to convince him that the total running cost of electricity would not exceed that of gas. Hot-plates of the black type were satisfactory for canteen work, but domestic consumers would never be satisfied with this type of hot-plate, the invariable complaint against them being that they were too slow. The radiant hot-plate, on the other hand, gave great satisfaction. This type of plate was now being used in very large numbers in Barrow.

Mr. H. D. **Symons** said that the point of view of convenience was not sufficiently appreciated; convenience was frequently to be considered before cost. The actual cost for energy was very small compared with the cost of the materials cooked. The softening or disintegration of mica when subjected to high temperatures was due to the dehydration of the moisture of crystallisation, and those micas having the highest percentage of moisture of crystallisation were the best for use in the manufacture of heating elements. Nevertheless, it was only a question of time before the best mica, when subjected to a temperature of 400 deg. to 500 deg. C., would disintegrate.

Mr. H. T. **Wilkinson** said those who dined at the Club that night had a dinner cooked by gas. This installation was put in originally because capital expenditure was an important matter when starting a club; also the Gas Committee made a tempting offer of free apparatus. Now that the membership had so much increased an extension to the cooking apparatus was necessary to ensure quick service, and they had decided to install the all-electrical apparatus. Although the capital cost was heavy it was justified, for the following reasons:—An additional hot cupboard was necessary to ensure quick service. They had not found the gas hot-cupboard satisfactory. The gas burners gave trouble. The heat was unequal, and dried up the food. They found the gas grill unsatisfactory, as it was necessary to wait about 20 minutes before one could get a chop or steak. It took 10 minutes for the grill to heat up before it cooked at all. The installation of more gas apparatus would have involved another large iron hood, which would have been expensive and awkward to fix in the centre of the kitchen to get the fumes away. They had already had to install a fan in the kitchen to exhaust the fumes, as the staff suffered in health. The running cost would be approximately the same as with gas, more especially considering the high cost of meat and the possibility of reducing the loss in weight. The cost of gas-cooking was about 0.9d. per meal served.

Mr. A. S. **Barnard** said that at a works just outside Manchester there was a 20-kw. electrical kitchen catering for 80 to 100 people every day. The electricity for cooking the dinners averaged ½ unit per meal.

Mr. W. A. **Gillott**, in reply, said that with electricity at ¾d. per unit or under, and gas at 2s. 8d. per 1,000 cu. ft. or over, he would certainly install electrical apparatus as being the better proposition, taking into consideration running and maintenance costs, convenience, and fire risks. Mr. Thomas seemed to fear an increase in price of electricity when electrical cooking became more general. In the early days when lighting was the mainstay, low rates were quoted to induce consumers to use motors. In the majority of cases the station peak was now caused by the power load, and the rates had come down, and he thought the same would apply to electrical cooking. The washing-up arrangements shown in his fig. 3 were a distinct improvement upon the machine described by Mr. Thomas. This kitchen was in a canteen where all meals were served first, and no soiled plates were collected until the diners had finished their meal. The plates, &c., were collected and placed in wire frames in which they were washed, sterilised, dried, polished, and stacked. The self-contained apparatus in the schedule could not, in his opinion, be reduced if good results in the kitchen were desired. The question of meat shrinkage was really a secondary consideration; he did not agree with the figure of 3 per cent. only in favour of electrical cooking. He had carried out tests where the shrinkage had been only 5 per cent., while there was as much as 57 per cent. shrinkage with a coal-fired oven. Wiring faults were mostly in flexible metallic tubes. By the adoption of solid type connections on certain apparatus these faults had been overcome. It was not necessary to provide for a rapid ventilation with an electric oven, as no combustion took place, the only ventilation necessary being to carry off the steam from cooking, which was provided for by a small hit-and-miss ventilator. In Newcastle they did not find that the cooking load clashed with the power load. With self-contained vessels he had not experienced any difficulty in fish frying. He had tested both the closed and open or radiant type of hot-plates; the closed plate had the advantages of longer life, more robust construction, and better facilities for heat regulation; for the open or raidant type was only better for the first "boil." To provide heat regulation one must either use a duplicate winding or employ a thin wire, which resulted in a short life. He did not think much saving would be effected by the use of thermostatic control in ovens, but they could be employed with advantage in water-boiling and soup-making in large quantities. Mr. Symons apparently arrived at the conclusion that the convenience of electrical cooking was to be taken into consideration when the consumer paid his electricity bill. This was not the case; on the score of running cost alone, electricity was cheaper than gas, on the basis of ¾d. per unit and 2s. per 1,000 cu. ft. He considered fireclay or similar material to be more suitable than mica for grills of the restaurant type.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,138. "Control and protection of compound-wound electrical machines." J. E. Goodwin. April 29th.

7,164. "Electromagnetic brakes, clutches, ratchets, &c." E. C. Villiers. April 29th.

7,175. "Secondary batteries." Q. Marino & C. Bowen. April 29th.

7,178. "Distributors for high-tension ignition devices." R. Bosch Akt. Ges. April 29th. (Germany, May 26th, 1917.)

7,181. "Dynamo-electric machines." Sir C. A. Parsons & J. Rosen. April 29th.

7,188. "Apparatus for chemical and electro cleaning and depositing metals." J. J. Mayrow. April 29th.

7,205. "Ignition of internal-combustion engines." L. E. Clulee. April 30th.

7,212. "Electrical terminal attachment." E. G. Iley. April 30th.

7,226. "Ignition magneto for explosion engines." R. F. Bassi. April 30th. (Italy, June 30th, 1917.)

7,244. "Magnetic apparatus for indicating vertically and orientation in inclined bodies subjected to centrifugal force." J. T. Clarke. April 30th.

7,245. "Manufacture of the metal magnesium by electrolysis." E. A. Ashcroft. April 30th.

7,252. "High-frequency signalling." Western Electric Co. April 30th. (U.S.A., September 5th, 1916.)

7,261. "Driving mechanism for magneto lamps, &c." O. Junghans. April 30th. (Germany, May 14th, 1917.)

7,281. "Contact-breaking devices for magneto-electric machines, &c." E. F. Holbrook. May 1st.

7,308/9. "Machine switching telephone exchange systems." L. Polinkowsky & Western Electric Co. May 1st.

7,313. "Double-current dynamo machines." R. Bosch Akt. Ges. May 1st. (Germany, May 15th, 1917.)

7,314. "Double-current dynamos for switch installations." R. Bosch Akt. Ges. May 1st. (Germany, June 1st, 1917.)

7,325. "Electrical distributors for internal-combustion engines." Fuller Accumulator Co. & A. W. B. Wilson. May 1st.

7,355. "Means for regulating and measuring alternating magnetic fluxes and forces in testing machines, &c." B. P. Halgh. May 2nd.

7,356. "Jointed arms or brackets for incandescent electric or gas lamps." H. C. Tofield. May 2nd.

7,364. "Electric starters and controllers." E. Schattner & J. R. Walton. May 2nd.

7,387. "Accumulator cell, and method of making same." H. S. Hawkins. May 2nd. (U.S.A., May 2nd, 1917.)

7,406. "Device for locking incandescent electric lamps in their holders." G. F. Colson. May 3rd.

7,426. "Arc lamp lower-carbon holder." C. E. Lovesey & E. R. Stewart. May 3rd.

7,432. "Electrical instrument and method for detecting immersion, passage, and presence of metallic bodies in fluids." F. S. Thwaites. May 3rd.

7,443. "Convertible electric fire." E. A. Welsch. May 3rd.

7,444. "Electromagnetic trench mortar." A. S. Monk. May 3rd.

7,450. "Electric vacuum cleaners." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 3rd.

7,483. "Electromedical apparatus for diagnosis and treatment of partial deafness." E. E. Greville. May 4th.

7,491. "Slip-rings for magnetos, and manufacture thereof." F. B. Estcourt, T. W. Field Engineering Co., T. W. Field & T. R. Jones. May 4th.

7,513. "Insulator carriers for overhead telephone, &c., wires." H. W. Laxton. May 4th.

7,514. "Methods of connecting electric conductors." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 4th.

7,517. "Magneto generators." Elliott Bros., & E. F. Holbrook and W. Phillips. May 4th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

10,627. Electrical Transmitting Apparatus applicable to Controlling Advertising and other Devices from a Distance. H. K. Harris. July 27th, 1916. (114,633.)

1917.

555. Telegraph Printers. E. E. Kleinschmidt. January 11th, 1917. (114,636.)

3,274. Dynamo-electric Machinery. Lancashire Dynamo & Motor Co. and G. E. Mason. March 6th, 1917. (114,638.)

4,196. Electrical Transmitting Apparatus applicable for Controlling Advertising and other Devices from a Distance. H. K. Harris. March 23rd, 1917. (Addition to 10,627/16.) (114,646.)

6,461. Electric Starters for Internal-combustion Engines. M. S. Conner. May 7th, 1917. (114,690.)

6,631. Momentary Contact Electric Switches for Cancelling Mining Visual Signals. G. Saint. May 10th, 1917. (114,693.)

7,122. Radio-signalling Systems. L. de Forest & C. V. Logwood. May 23rd, 1916. (107,001.)

7,449. Sparking Plugs for Internal-combustion Engines. T. H. R. Key. May 23rd, 1917. (114,703.)

8,467. Electric Voltage Regulators. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 13th, 1917. (114,715.)

8,579. Watertight Fitting for Electric Lamps and the like. W. Harrison & R. E. H. W. Eyre. June 15th, 1917. (114,719.)

8,627. Protective Apparatus for Dynamo-electric Generators. W. T. Tallent-Bateman. June 15th, 1917. (Addition to 1,671/15.) (114,720.)

9,111. Electrical Condensers for High-tension and High-frequency Currents. A. Kowalski. June 24th, 1916. (108,468.)

9,480. Protective Apparatus for Alternating Electric Current Circuits. H. Pearce. June 30th, 1917. (114,729.)

10,191. Electric Valves or Safety Devices for the Discharge of Excess Voltage. G. Giles. July 13th, 1917. (114,739.)

12,572. Electric Heating and Cooking Apparatus. G. Pate & A. R. Wood. September 1st, 1917. (114,757.)

12,611. Vehicle Lamps. H. Lucas & W. H. Egginton. September 3rd, 1917. (Cognate application, 1,604/17.) (114,758.)

13,029. Rheostats. Sykes Interlocking Signal Co., W. R. & R. W. Tarrant. September 11th, 1917. (114,761.)

14,932. Electric Furnaces. J. L. Dixon. October, 1916. (111,103.)

15,849. Electric Torches. R. E. H. Fletcher. October 31st, 1917. (114,777.)

16,800. Sparking Plugs for Explosion Motors. P. G. Mitard. November 15th, 1917. (114,781.)

1918.

2,018. Thermic Telephones and Microphones. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. March 27th, 1917. (114,418.)

"Overshooting" with Tungsten Lamps.—In the *Electrical World* of March 2nd, Mr. C. J. Berry discusses the initial rush of current caused by the resistance of the cold tungsten-filament lamp being low compared with its resistance when hot. In the vacuum type the ratio is about 1 to 11·5, and in the gas-filled lamp 1 to 14·6. The author finds that the maximum current is reached in 0·0004 to 0·003 second, and the current falls to normal in 0·1 to 0·2 second. The maximum current is from 12 times the normal in a 75-watt gas-filled lamp to 7 times in a 1,000-watt lamp. There is absolutely no cause for fuses to blow or circuit-breakers to open when a lamp load is thrown on, provided that the cut-outs are properly rated for the load, as the effective current during the brief period of 0·1 to 0·2 second is only about double the normal value.

Portable Sub-station for Serving Emergency Loads.—The Portland (Ore.) Railway, Light and Power Co. has equipped a flat car so that it can be dispatched to any industrial plant in its territory which has a railroad siding when a sudden demand for electric service is made. This portable sub-station is used to supply energy temporarily until permanent equipment can be installed. It has been found especially useful in serving factories when their isolated plants break down. The equipment carried on this flat car includes a 400-kw. rotary converter, three 11,000/440-volt air-blast transformers, a 28-in. motor-driven blower, and the necessary switching and measuring apparatus. Over the equipment is built a wooden framework which can be covered with asbestos and tar paper to protect the apparatus from the weather. After the car is hauled to the place where it is to give service the weight is taken off the springs by jacking up the body, thus preventing excessive vibration during operation.—*Electrical World.*

THE

ELECTRICAL REVIEW.

Vol. LXXXII. MAY 24, 1918. No. 2,113.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

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THE TRAINING OF ENGINEER OFFICERS.

THE *Génie Civil* quotes from a speech delivered by Dr. von Rieppel, President of the Verein deutscher Ingenieure, a criticism of the training of German officers which, in view of certain facts which have come to our knowledge, is not without interest to our own authorities. The speaker said that Germany did not foresee that the war would become an economic and technical war; the military schools were designed solely to produce men fitted to command, and familiar with the art of war, and economic and technical questions were practically ignored by them. He had been struck by the difference between their own ideas on this subject and those of the French when he visited the Universal Exposition of 1900; as a member of the jury on civil engineering works, he had several times had to judge splendid buildings of which the architect was a French officer, and he was surprised to learn that a large number of French officers received a very comprehensive training, and at the end of their studies had to pass examinations in engineering. These young officers often acted as engineers, especially in the colonies, where they were able to make use of their general knowledge and render valuable service in connection with economic and technical matters. There was nothing of this kind in Germany, and this deficiency had led to serious results. During recent years the technology of the arms of war had made unprecedented progress; industry had provided the officer with greatly improved, but complicated, weapons, the mechanism of which he did not clearly understand. The German officer was accustomed to receive with material instructions for its use, and did not seek to become better acquainted with it, looking upon industrial technology as a thing apart, with which he need not trouble himself, and this false idea led him to under-estimate the value of industry with regard to the art of war. Modern weapons had to be served by specialists who must possess not only the usual qualities of the soldier, but, above all, technical experience and professional skill; the German officers were not fitted to control such men, for in their case the purely military point of view was a secondary consideration. In future the training of their officers must be regarded from a totally different aspect.

Now, we give place to none in our heartfelt admiration of the professional skill and indomitable courage of our Royal Engineers, who in their own sphere are unexcelled; but, through no fault of their own, if our information is correct, they suffer from precisely those deficiencies of training to which Dr. von Rieppel draws attention in the case of the Germans. We refer particularly to those branches of engineering which fall outside the military operations, such as the use of electric light and power, water supply, the industrial development of large areas of country, &c. It is quite a common thing to find behind our lines several little petrol-electric sets at work within a few yards of each other, each supplying a different department, and all, of course, devouring petrol, as well as capital outlay, and working under uneconomical conditions of loading, where a single properly-planned installation would have served the lot at less than half the cost, and twice the efficiency. Even where a local supply of electric power has been available, independent sets have been put down. Wholly unsuitable plant has been requisitioned from home owing to the lack of technical knowledge on the part of the local engineer officer in command. Petrol has been employed where coal would have been preferable, because the latter can be supplied by small vessels making short voyages, whereas petrol comes from far overseas in large and costly oil-ships, which are a special object of Hunnish hate, and can obviously only make one voyage for 10 by a collier. The cost of coal may be greater, though this is questionable—but here the importance of saving tonnage for food supply ought to be considered by *the engineer on the spot in France*. Again, in organising electric supply schemes regard should be had to the future, when peace returns; all such work should be carried out so as to be of permanent value to the French population, at their standard voltage and frequency, and on their recognised lines, so that the plant may be taken over by them on the most satisfactory terms—but is this done? We believe not, with the result that large sums are being expended with the smallest prospect of any ultimate return.

Such questions as these demand broad views and wide knowledge, which can only be gained in the school of experience. Their correct solution is of immense importance, not only to the efficient conduct of the war, but also to our finances and to the prosperity of the peoples concerned after the war. They may seem to be far-fetched; they are not. Narrow views on the scope of an engineer officer's duties and responsibilities are out of date, and must go. It may be thought that the problem can be solved by commissioning as officers men who in civil life are engaged in such work, and this is perfectly true, but only on one condition—that they are invested with full powers to carry out their plans without interference. This, we believe, has not been the case, and if such wide powers cannot be entrusted to engineer officers who are not professional soldiers, then the latter must be provided with such an adequate and catholic training in the sciences of engineering economics and industry as will enable them to carry out the work themselves.

Overwork and Under-Production.

It was perhaps somewhat unfortunate that the exigencies of the war situation necessitated at Eastertime the appeal issued by the Ministry of Munitions for suspension in munition establishments of the customary holidays. Subsequent letters to the Press, and complaints of overwork frequently heard in munition works, point to the fact that both employers and workmen are suffering from the effects of strain.

For the greater part of the war period the majority of munition workers have put in considerably more hours per week than during normal times, while working at greater pressure and under less favourable conditions. The fact that the returns of output have, for the most part, increased rather than decreased, is due as much to the magnificent organising abilities of the managers and foremen as to the patriotic efforts of the workers.

In spite, however, of vastly superior organisation and control, the tendency of late appears to be a marked decrease in the efficiency of the worker due to overwork and long hours. The position is further accentuated by the present substantial comb-out in munition works of men for the Forces. One of the inevitable results of this last move must be a further call upon the remaining workers to make good the loss in output. Are the workers, under these conditions, as capable as they will doubtless be willing to respond to the appeal?

In view of the fact that the cost of production in munition works is far in excess of what employers would sanction were the direction entirely under their own control, and not influenced by the Ministry, it is perhaps worth the consideration of those responsible that, however willing the workers may be to respond to urgent appeals, such appeals should be accompanied with an intelligent appreciation of the necessity for providing at the earliest opportunity the required rest and recreation.

The notice recently issued to munition works by the Ministry, notifying the workers that a record of bad timekeeping was about to be instituted, has a distinct bearing upon the foregoing remarks. The great proportion of time lost in munition works may be summarised under three distinct heads— Sickness, strain, and indifference. The difficulty which most managers are at present experiencing is to determine whether an absentee has been sick, as stated, or indifferent. The fact that there is so great an amount of both sickness and indifference is probably due to overwork.

So long as the workers feel that they have a just cause for grievance in this respect, all appeals or threats from the Ministry as regards bad timekeeping will probably fail to achieve the desired results.

Export Trade Combinations.

The new Act passed in the United States legalising the association of firms or corporations in the American export trade came into force on April 10th. It is entitled "An Act to promote Export Trade and for other purposes." We have referred to this matter editorially on several occasions. Some particulars of the measure will be found in the Board of Trade *Journal* for May 16th. Export associations will require to be registered, and they will not be permitted either in the United States or elsewhere to enter into any agreement, understanding, or conspiracy, or do any act which artificially or intentionally enhances or depresses prices within the United States of commodities of the class exported by such association, or which substantially lessens competition within the United States, or otherwise restrains trade therein. The "Webb" Bill, to which we drew attention in 1917, originated from a recommendation of the Federal Trade Commission, whose work we have also alluded to in these pages from time to time. It was clear from that Bill, as it is also from the Act now in force, that export trade combines are desired, and it is probable that a large number will be formed in the various trades of the States as a means for cultivating a greatly increased foreign trade, and meeting the efforts which Continental trusts may be expected to put forth. Our own Government Departments have been attacked by the merchants because they have advocated the same kind of effort on the part of British manufacturers. Such opposition, however, by the circumstances of the case, ought to be doomed to defeat. A policy of co-operation in export trade has been supported by us for many years past, and we regard it as inevitable, but if those who organise themselves into associations for carrying that policy into effect alienate the sympathies of those who have it in their power to help them they will be introducing instability at the foundations of the edifice they seek to build. The British technical and trade Press has done more than all the associations in existence in this industry to foster foreign trade and to keep connections alive during the period of the war. It has struggled with all sorts of adversity and difficulties, and has faced problems that neither secretaries nor publicity departments can have any knowledge of. Yet in spite of all those difficulties, circulars have reached our hands which contain an attack on the Press, accompanied by a series of half-truths and misrepresentations which are totally unworthy of any organisation possessed of the most ordinary feelings of common decency. We may have occasion to return to this matter.

LEEDS AUTOMATIC TELEPHONE EXCHANGE.

On Saturday last the new automatic exchange of the Post Office Telephone Department at Leeds was brought into operation. The exchange is of the full automatic Strowger type, for a five-figure system. Equipment is provided for 6,800 subscribers' lines, with an ultimate capacity for 15,000.

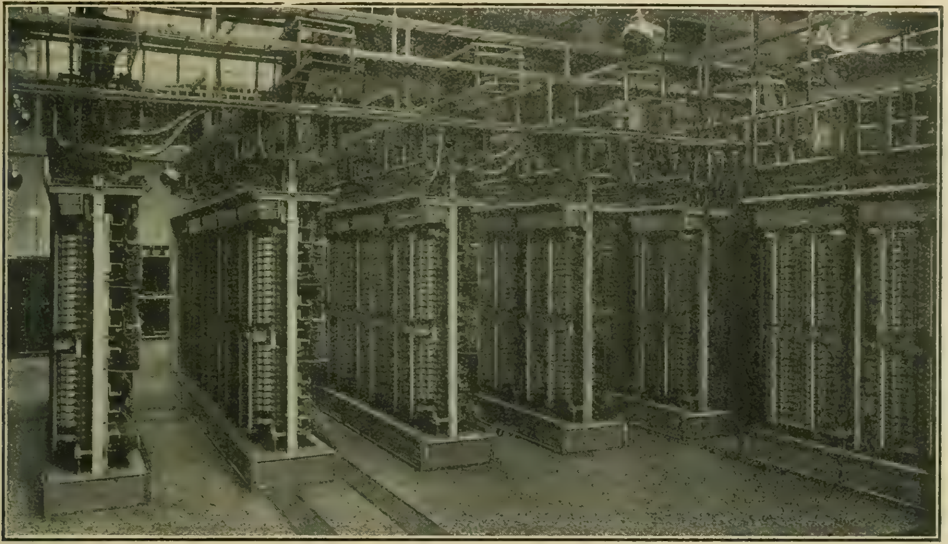

Fig. 1.—General View of Line Switch Units.

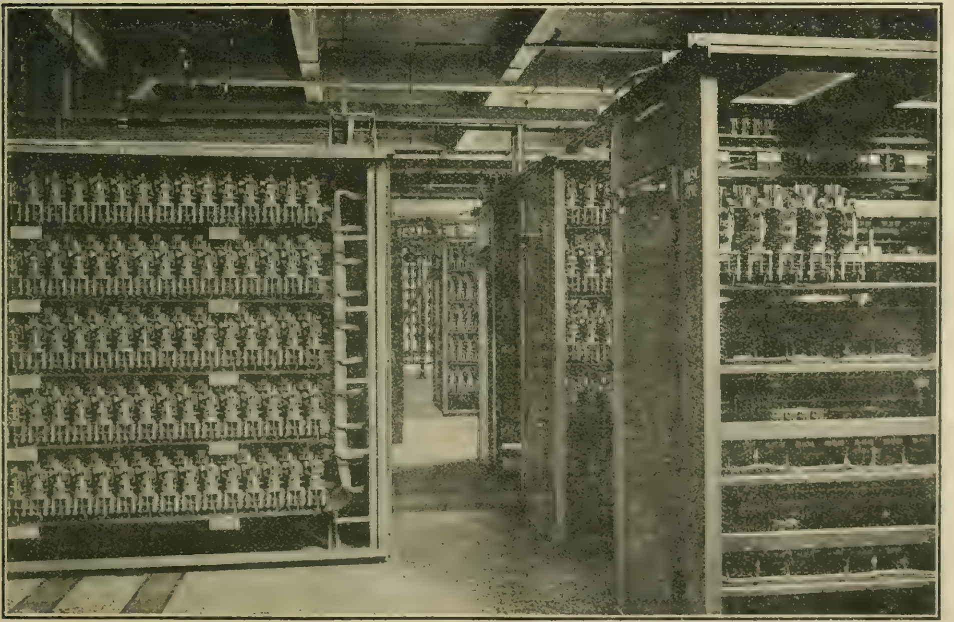

Fig. 2.—First Selector Boards.

Each subscriber's line terminates on a line switch circuit which, when energised by the removal of the receiver, extends the subscriber to one switch out of a group of first selectors. This apparatus receives the impulses from the subscriber's dial for the first digit, and extends the line to a second selector to accept the impulses for the second digit; similarly a third selector deals with the third digit, and finally a connector switch receives the tens and units digits, and connects the calling subscriber to the wanted line.

The plant provides for 68 units, each capable of accommodating 100 subscribers' lines; 46 of these units are designed each to carry a maximum of 10 *originated* calls simultaneously, with a capacity for 20 calls; the remaining

22 are each fitted for a maximum load of 20 originated calls simultaneously. For calls *incoming* to each unit, the design is as follows :—

4 units connector switch capacity for 19 calls ; switches fitted for 14 calls simultaneously.
6 units connector switch capacity for 19 calls ; switches fitted for 13 calls simultaneously.
2 units connector switch capacity for 16 calls ; switches fitted for 13 calls simultaneously.
10 units connector switch capacity for 16 calls ; switches fitted for 12 calls simultaneously.
46 units connector switch capacity for 16 calls ; switches fitted for 10 calls simultaneously.

Trunk and junction calls originated by subscribers are obtained by dialling "0," and 200 outlets are available for this service. These lines terminate on manual positions in the Leeds Trunk Exchange fitted with a multiple of the junctions and short trunk circuits outgoing to other exchanges, so that, as far as possible, a "no-delay" service for such calls will be afforded. For long-distance calls, the calls are ticketed, and mature from a group of additional positions in the Leeds Trunk Exchange, each position being fitted with a group of junctions outgoing to the Automatic Exchange ; 226 junctions to the Automatic Exchange are available, each terminating on a 1st selector switch. Calls from distant sub-exchanges for Leeds subscribers are dialled direct by the sub-exchange operators. In this manner 144 circuits are operated, each circuit terminating on a 1st selector in the Automatic Exchange. To obtain trunk and junction calls over these circuits the sub-exchange operator dials "0," and obtains the manual operator in the Leeds Trunk Exchange ; 40 circuits, separate from those used by subscribers, are provided for this purpose. This group of lines is marked to indicate to the Leeds operator that the call is from a sub-exchange, and will be controlled at that point.

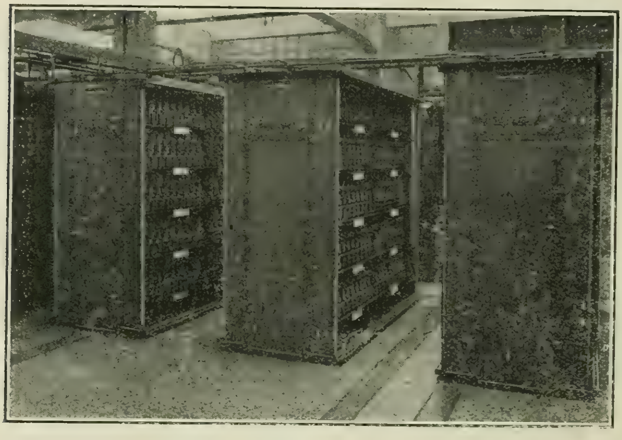

Fig. 3.—Second Selector Boards.

The manual board in the Trunk Exchange also deals with calls originated by call-office subscribers, so that the necessary fee can be collected. Two 100-line switch units are set apart for this service, the trunks outgoing from these units being wired so that immediately the receiver is taken off the hook the caller is connected to the manual position. The circuits are therefore dealt with precisely on manual lines for originating calls. Calls incoming to such numbers are, however, dealt with automatically, as in the case of an ordinary automatic subscriber. Coin-box and party-line subscribers are dealt with on a full automatic basis. The former have access to a separate group of "0" level circuits for trunk and junction calls, to indicate to the operator that the coins should be deposited before the connection is established. For calls to automatic subscribers, the apparatus at these subscribers' offices is designed to short-circuit the transmitter, when the called subscriber replies, until the penny is deposited. The party-line subscribers are arranged on a two-party-line basis, one subscriber "X" being rung on the "A" line, and the other "Y" on the "B" line; each subscriber is allotted a separate number in a different hundred group, the connector switches of the "Y" group being arranged to ring on the "B" line, instead of on the "A" line, as for other switches.

Originating calls from party-line subscribers are dealt with on a line switch common to the two subscribers, and mature similarly to those of ordinary direct subscribers.

The necessary electrical energy for operating the Automatic Exchange switches, and providing the talking current for the subscribers' instruments, is derived from a 46-volt storage battery. This battery is in duplicate, so as to eliminate any risk of breakdown ; one battery is kept charged whilst the other is in service. The batteries are charged by a motor-generator set driven from the electric supply mains.

The Automatic Exchange equipment embodies the latest developments in automatic telephone exchange working :—

1. Facilities are available on primary line switch units for cross-connecting subscribers' lines to any line switch, thus affording means for distributing the originating traffic equally throughout the exchange.

2. Secondary line switches are fitted between the primary line switches and 1st selectors, to enable the originating traffic from each group of 100 subscribers to be spread over a larger group of selectors. Each of the trunks outgoing from the primary line switches is distributed among different groups of secondary line switches, each such group having access to 10 1st selectors. This scheme provides for the distribution of the traffic more uniformly over the entire exchange, and so affords better traffic conditions.

3. When the called subscriber is engaged, a "busy-back" tone is given to the originating subscriber; if the engaged subscriber is called from the manual board, a "busy" flash signal is transmitted to the operator's cord circuit.

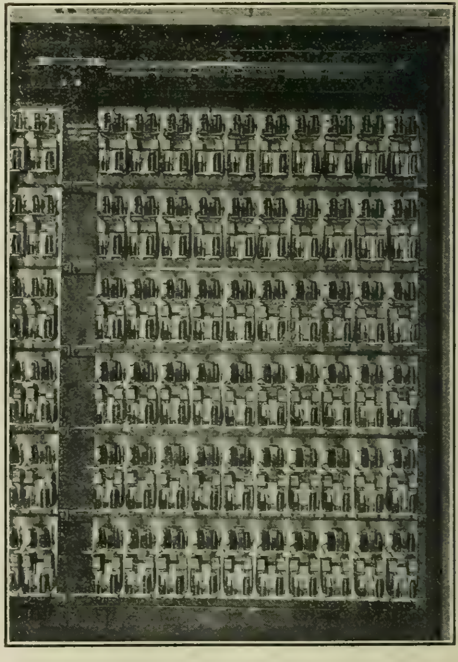

Fig. 4.—Repeater Rack.

4. When a called subscriber replies, the ringing current is tripped immediately.

5. The number of routes incoming to any unit can be varied without altering the permanent wiring. Increases in load incoming to any unit can thus be dealt with by merely inserting a connector switch on one of the spare multiple banks provided.

6. The meter of the originating subscriber is operated for completed calls between two automatic subscribers only.

7. Each switch, and the outgoing and incoming routes for each switch, are so designated as to enable calls to be traced backwards or forwards to the next switch without difficulty.

8. An alarm circuit is extended to the manual board during the night and on Sundays, when no engineering staff is on duty in the automatic exchange. The alarm is associated only with those circuits which actually affect the working of the Exchange—such as fuses blown and failure of ringing.

9. The master switch controlling the line switches associated with each primary and secondary line switch unit can be removed without displacing the line switches.

10. Standard positive supervision is afforded on the manual positions in the Leeds Trunk Exchange on all calls to and from automatic subscribers. Similar facilities are afforded to the sub-exchange operator dialling direct on the Automatic Exchange.

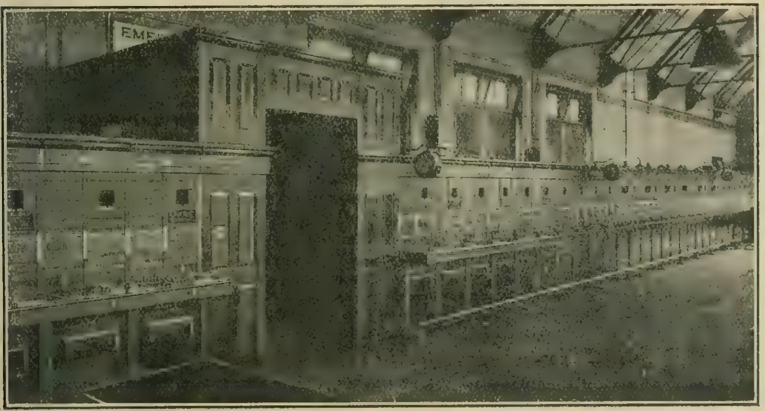

Fig. 5.—Toll Board.

The following is a complete list of the automatic installations which have been provided by the British Post Office :—

Exchange.	Type of equipment.	Date opened.	Extent of equipment.	
			Present.	Ultimate.
Accrington ...	A	13/3/15	700 lines	1,500 lines
Blackburn ...	A	14/10/16	2,400 "	4,400 "
Chepstow ...	A	7/7/15	65 "	90 "
Dudley	W	9/9/16	500 "	1,600 "
Darlington ...	W	10/10/14	800 "	2,800 "
Epsom	A	18/5/12	500 "	1,500 "
Grimsby	S	Not yet opened	1,300 "	4,000 "
Hereford ...	L	1/8/14	500 "	900 "
Leeds	A	18/5/18	6,800 "	15,000 "
Newport (Mon).	A	14/8/15	1,800 "	3,500 "
Official	A	13/7/12	700 "	1,500 "
Paisley	A	15/7/16	1,100 "	2,150 "
Portsmouth ...	A	29/4/16	5,000 "	7,000 "
Stockport ...	S	Not yet opened	950 "	2,260 "

A denotes Automatic Telephone Manufacturing Co., Liverpool.
W " Western Electric Co., Woolwich.
S " Siemens Bros, Woolwich.
L " Lorimer System. Canadian Machine Telephone Co., Brantford, Canada.

The inauguration of the new exchange took place on Saturday last at 2 p.m., the change-over being started by the Right Hon. A. H. Illingworth, H.M. Postmaster-General; the actual transfer from the old to the new exchange occupied an astonishingly short time, being practically instantaneous. This exchange, which is the largest automatic exchange in Europe, has involved the laying of over 26,000 wires into the new building. For the past two or three years the Post Office engineering staff has been engaged on the complete rearrangement of the installations at the subscribers' offices, and, in addition, a large staff has been occupied in rearranging roof standards and overhead wires, generally replacing them to a large extent by underground cables. This work, together with the inspecting and testing-out of the Exchange installation, has been carried out by the local P.O. engineering staff, under the general direction of Mr. T. B. Johnson, superintending engineer of the North-Eastern District of England; Mr. E. H. Farrand has been responsible for the cabling and other line work, and Mr. E. S. Francis for the apparatus. Besides the Postmaster-General, others who were present at the opening ceremony included Sir Wm. Slingo, Engineer-in-Chief, G.P.O.; Mr. Dane Sinclair, Managing Director, Automatic Telephone Manufacturing Co., Ltd.; Mr. R. A. Dalzell, Chief Inspector of Telegraphs and Telephone Traffic, G.P.O., and many members of the Post Office commercial and engineering staffs. When the transfer was completed the Postmaster-General made the first "call," after which each subscriber's line was tested individually. In the course of a speech Mr. Illingworth said the new system was an illustration of the transference from absolute dependence upon the individual, to reliance upon the mechanical and automatic. He had been criticised for completing this installation in war-time, but he pointed out that the contracts had been placed so long ago as 1912, and actually the equipment was ready before the war broke out. When he inspected the unsatisfactory arrangements in the old manual exchange, he felt that such criticism was entirely out of place. He congratulated Mr. Johnson and the whole of the telephone staff upon the efficient manner in which the installation had been put into working order. Sir Wm. Slingo also spoke, and said it was one of the proudest moments of his life to see that exchange opened. For many years they had been struggling hard to get the automatic principle recognised. Automatic machinery must replace human effort in telephony, as in most other branches of industry; nothing could stop it, and the sooner the country developed this system thoroughly and comprehensively, the better it would be. The longer the development was delayed, the greater would be the amount of capital that would have to be sunk and ultimately scrapped in pursuing the manual system. The manual instruments displaced in Leeds were to be sent for war service at the Front. He now wanted to see Bradford linked up with the automatic service, so that Leeds and Bradford could work together.

In the evening a dinner was given at the Queen's Hotel by the directors of the Automatic Telephone Manufacturing Co., Ltd., to celebrate the occasion.

Electrotherapy.—The construction of a new electro-therapeutic and massage department has been completed at the Great Northern Central Hospital. It is estimated that 1,000 patients a year will attend. *The Times.*

THE STANDARD RESISTANCE AND TEMPERATURE COEFFICIENT OF PURE ANNEALED COPPER.

By H. SAVAGE.

The average electrical engineer is often confused by the conflicting figures given by various authorities both for the standard resistance of copper and its temperature coefficient. The resistance is variously quoted for a certain section in square inches in lengths of 1,000 yards or one mile, or for the weight in pounds of such length, at various temperatures Fahrenheit, or in metric units and degrees of temperature Centigrade. The temperature coefficient is quoted per degree Fahrenheit or Centigrade, as the case may be, starting from various base temperatures as unity.

The standard resistance generally accepted for the past 18 years is that of the Committee on Copper Conductors, whose report was published in 1900 in the *Journal* of the I.E.E., Vol. XXIX, page 169, viz. :—

> Resolved that Matthiessen's standard of ·150822 standard ohm resistance for a wire 1 metre long weighing 1 gramme at 60° F., be taken as the standard for annealed high-conductivity commercial copper.

From this, and the coefficient also adopted by them, and assuming a specific gravity of 8·912, it was calculated that one mile of copper of 1 sq. in. sectional area had a resistance of 0·042317 standard ohm at 60° F. The Committee also resolved :—

> That Messrs. Clark, Forde & Taylor's temperature coefficient, as published in their pamphlet dated February 20th, 1899, be adopted, and that the average coefficient of 0·00238 per degree Fahrenheit be adopted for commercial purposes.

Although it can be shown that Matthiessen, in his work from 1858 to 1864, never set out to determine a standard for copper, yet the above resolutions were taken by common consent as a practical definition of what had come to be regarded as "Matthiessen's standard."

The Engineering Standards Committee, in 1904 (Interim Report, No. 7), accepted these resolutions in principle, but with slight variation in terms. They also took a specific gravity of 8·90, which gave a practical figure of 555 lb. per cb. ft. at 60° F. The Tables of Resistance of Copper Conductors issued by the E.S.C. were calculated on these standards.

In 1910 an investigation was made at Washington by the United States Bureau of Standards to determine the resistance and temperature coefficient of annealed commercial copper as produced under modern conditions by electrolytic methods. The results were published in the Official Bulletin of the Bureau, Vol. VII, No. 1. This gives the resistance as 0·153022 standard ohm for a wire 1 metre long weighing 1 gramme at a temperature of 20° C., a specific gravity of 8·89, and a linear temperature coefficient of 0·00394 per degree Centigrade. The Bureau proposed that these figures should be adopted as international standards.

It was shown that the temperature coefficient varied with the purity of the copper, but the figure given was for pure copper of the resistance quoted. It was also shown that the resistance varied by a definite amount per degree difference in temperature and not by a fixed percentage.

Researches had been made in other countries, and in 1913 the International Electrotechnical Commission adopted International Standards which approximate very closely to the American figures. The I.E.C. standards are :—

> 1. At a temperature of 20° C. the resistance of a wire of standard annealed copper 1 metre in length and of a uniform section of 1 sq. millimetre is 1/58 ohm = 0·017241 ohm.
> 2. At a temperature of 20° C. the density of standard annealed copper is 8·89 grammes per cb. centimetre.
> 3. At a temperature of 20° C. the "constant-mass" temperature coefficient of resistance of standard annealed copper, measured between two potential points rigidly fixed to the wire, is 0·00393 = 1/254·45 per degree C.

The resistance and density have been accepted by the Institution of Electrical Engineers, and issued in their Wiring Rules, 1916. These quote in a Table (page 30) the calculated resistance of electric conductors in standard ohms per thousand yards at 20° C., although the dielectric resistance in the corresponding column of the same table is in terms of megohms per mile at 60° F. How is the practical man to reconcile these figures, and what resistance shall he accept for every-day use? It is difficult to understand why, after a standard temperature of 60° F. has been sanctioned by long usage, he should be asked to express the conductor resistance of a cable at 20° C. and its dielectric resistance at 60° F.

Although it is highly desirable to adopt an international standard of resistance, it certainly should, in the writer's opinion, be expressed in the customary British units.

There is little difference in the actual resistance of annealed commercial copper as determined by various experimenters, but the practical man is quickly involved in difficulties when he attempts to bring the data to a common basis by means of the temperature coefficients quoted. It is necessary to get a clear idea of what this coefficient really is. The finding of the U.S. Bureau of Standards may be accepted, viz., that the resistance varies by a definite amount per degree. If this amount be calculated as a percentage, or a proportion of any resistance at a certain temperature, it gives a certain ratio, but if it be calculated on the resistance at a lower temperature, it will give a higher ratio, *i.e.*, the temperature coefficient will be higher when it is calculated from a lower temperature basis. An imaginary case will make this clear.

Assume that a wire at 60° F. had a resistance of 100 ohms, and that for every degree difference in temperature its resistance varied by 1 ohm, it would have a coefficient of 1 per cent., starting from 60°. The same wire at 40° would have a resistance of 80 ohms, but its temperature coefficient would be $\frac{1}{80}$ = 1·25 per cent. It is this point which is frequently overlooked.

A commercial analogy illustrates the point. A dividend of, say, 5 per cent. may be paid on stock of the nominal value of £100, but the percentage dividend to the investor depends upon the actual price paid for the stock.

Matthiessen's coefficient, determined in 1862, was not linear, *i.e.*, did not follow the straight-line law, but employed a formula involving two functions.

Messrs. Clark, Forde & Taylor, in 1899, found that the coefficient was practically linear, and they gave temperature coefficients per degree Fahrenheit as follows :—Starting from 32° F., it was ·00237; from 60° F., it was ·00224; and from 75° F., it was ·00217.

The Committee on Copper Conductors in 1900, and the E.S.C. in 1904, adopted the average temperature coefficient of ·00238. This is misleading unless qualified, as this figure is only correct when reducing to a standard temperature of 32° F., while in practice a standard of 60° F. was adopted and is implied by the other data in their report. It is evident that the proper coefficient should have been ·00224. The value of ·00238 frequently appears in Official Specifications as referring to 60° F.

The U.S. Bureau of Standards found the coefficient linear between 10 and 100° C. (50 and 212° F.), and nearly linear below 10° C. (150° F.).

The I.E.C. adopts a linear coefficient, but states that tests should be made between 10° and 30° C. (50—86° F.).

The following table is calculated to show the coefficients according to the various authorities, at certain temperatures in use :—

Deg. C.	Deg. F.	1.	2.	3.	4.	5.
0	32	·00215	·00237	Average,	·00238	·002370
15	59	·00212	·00224	·00238	·00223	·002227
15·5	60	·00212	·00224		·00223	·002222
20	68	·00211	·00220	Should be	·00219	·002183
23·9	75	·00209	·00217	·00224	·00215	·002150
25	77	·00208	·00216	at 60° F.	·00214	·002141

1 = Matthiessen, 1862.
2 = Clark, Forde & Taylor, 1899.
3 = Committee of Copper Conductors, 1900, and Engineering Standards Committee, 1904.
4 = United States Bureau of Standards, 1910.
5 = International Electrotechnical Commission, 1913.

It will be seen that the correct coefficient at 60° F. on the international basis is ·002222, and it will be sufficient to take this figure for any temperature likely to be met with in practice.

The resistance of a conductor at a standard temperature being known, the resistance at any higher temperature can be obtained from the following formula :—

If R_s = Resistance at standard temperature.
R_x = ,, ,, the higher ,,
C = Coefficient per degree at standard temperature.
N = Number of degrees difference.
Then $R_x = R_s \times (1 + C N)$.

Most text-books refer only to the use of a coefficient in the above form—that is, on an ascending scale. When it is required to find the resistance at a *lower* temperature, the user not infrequently takes the factor $(1 + C N)$ and divides it into the resistance at standard temperature, thus—

$\left(\frac{R_s}{1 + C N}\right)$ which gives an incorrect result.

The proper formula is $R_x = R_s \times (1 - C N)$.

The best method to avoid errors of this kind is that adopted by Messrs. Clark, Forde & Taylor—viz., to use a series of *ratios* that the resistance at any temperature bears to the resistance at a standard temperature. The most practical plan is to use a table of ratios from 32° to 212° F. (0—100° C.) with 60° F. as unity.

The I.E.C. report only authorises the use of the coefficient between 10° and 30° C. (50° to 86° F.), but the United States Bureau of Standards has shown that the coefficient is linear up to 100° C., so that the table can safely be carried up to that temperature—viz., 212° F. The latter authority states that the coefficient is not quite linear below 10° C. (50° F.). The departure, however, is very small, and if the table is carried down to 32° F. on the same basis, the error will be negligible in practice.

The following table is based on the I.E.C. coefficient correct to 60° F., and subject to these assumptions :—

Ratios of Resistance of Pure Annealed Copper.

T° F.	Ratio.	T° F.	Ratio.	T° F.	Ratio.
212	1·3378	75	1·0333	52	0·9822
200	1·3311	74	1·0311	51	·9800
190	1·2889	73	1·0289	50	·9778
180	1·2666	72	1·0267	49	·9755
170	1·2443	71	1·0244	48	·9733
160	1·2222	70	1·0222	47	·9711
150	1·2000	69	1·0200	46	·9689
140	1·1778	68	1·0178	45	·9667
130	1·1555	67	1·0155	44	·9644
120	1·1333	66	1·0133	43	·9622
110	1·1111	65	1·0111	42	·9600
100	1·0889	64	1·0089	41	·9578
90	1·0667	63	1·0067	40	·9555
85	1·0555	62	1·0044	39	·9533
84	1·0533	61	1·0022	38	·9511
83	1·0511	60	1·0000	37	·9489
82	1·0489	59	0·9978	36	·9467
81	1·0467	58	·9955	35	·9444
80	1·0444	57	·9933	34	·9422
79	1·0422	56	·9911	33	·9400
78	1·0400	55	·9889	32	·9378
77	1·0378	54	·9867		
76	1·0355	53	·9844		

Having determined the coefficient and the method of using it, a standard resistance can be easily calculated.

On the I.E.C. basis the resistance of an annealed copper conductor of a uniform section of 1 sq. in. at a temperature of 60° F., is 0·02401 ohm per 1,000 yards, or 0·042258 ohm per statute mile.

If tables for the resistance of electric conductors are calculated from the foregoing figures, the international standards will have been accepted, but in terms with which practice has made electrical engineers familiar.

Their adoption, therefore, would be distinctly advantageous until the general use of the metric system in this country renders them obsolete.

Zinc in Tasmania.—The Electrolytic Zinc Co., Risdon, Tas., has started up the first unit of its working plant. The estimated capacity is 10 tons daily, but it is anticipated that the output will be 15 tons.—*Chem. Eng. and Mining Review*.

A BRITISH ELECTRICAL PROVING HOUSE.

At a meeting of the Newcastle Local Section of the Institution of Electrical Engineers on May 13th, Mr. C. Turnbull read his paper on this subject. An abstract of the paper appeared in our issue of May 10th. At the conclusion of the paper he said that the question was one that Mr. Wordingham was paying great attention to, and it was the intention of the Council that something should be done. It was suggested that the National Physical Laboratory should do the work, and undoubtedly, he thought, that was the best body to do it. It was felt by manufacturers and others that the proving house should be British in its widest sense. If the idea were supported he had every hope that it would come into being.

Mr. J. J. Jackson said he thought there was a very strong reason why the proposal should go forward. No one doing work in factories could fail to realise the serious waste of time due to inferior material. There was a marked difference between old material and the more modern. Modern material was of little value mechanically, with the result that it had frequently to be replaced.

Dr. Thornton said he was sure they must support that proposal; it was a matter of life or death to have something of that kind. The National Physical Laboratory was the proper channel. He thought they were indebted to Mr. Turnbull for raising the question. Emphasising the need for such an institution, Dr. Thornton instanced the case of flame-proof lamps, and said that matter was not in a satisfactory position, for it was in the hands of the chemists, and he did not think that was quite the right thing.

Mr. H. S. Ellis also spoke in support of the suggestion. With regard to the larger manufactures the goods turned out, he thought, were fairly good, but with regard to the smaller work the case was different. He thought that to make the scheme effective they would have to have legislation. One of his difficulties was that he had no jurisdiction to inspect work in houses. When they were testing insulation they had no right to pull up a floor-board to see whether the work was all right.

Mr. Pinkney expressed the opinion that to have everything standardised would be a tremendous advantage to everybody. There might be three grades in some materials, suitable for the different classes of work.

Mr. W. Cross spoke in support of the idea of a proving house, but he hoped that in working out the details they would not make the cost of electrical installations so great that they would prevent the public using electricity, or drive those who wanted a cheap installation to foreign rubbish. They did not want enormous factors of safety, and he believed good material could be obtained, but there was a great deal of rubbish on the market. He believed that the bulk of faults were due to bad workmanship rather than bad materials. Large quantities of cheap German cable were guaranteed to conform with the C.M.A. specification. The principal objection to the scheme was that it would be of little use having the proving house unless they were going to enforce the use of the material that had been passed by it.

Mr. Carter said that the testing house would do something in popularising the rules and making their meaning clearer. It seemed to him that a proving house might tend to bring many things into the open for discussion so that rules would not be drawn up, as in the past, in a hole-and-corner manner.

Mr. Andrews said they would not get the State Departments to go to the Proving House unless it was compulsory. The Post Office had the most elaborate method of testing cables. He thought there was not much chance of an electrical proving house unless they had a proving house for all the main classes of engineering products.

Mr. Hunt thought it would go a long way if they could get the support of the insurance companies.

Mr. MacCall also referred to the need of legislation, but said it was possible to get things tested now, and people did not use the facilities that were available. If the test were made by someone independent of supplier or maker then, he thought, the test would be accepted as fair.

Mr. Fawsett was of opinion that in the testing of samples, extreme cost would have to be avoided. He hoped that in the development of the idea the manufacturers would not be allowed to have too much to say.

Mr. Simon said he took it that the real object of the proving house would be to certify that samples sent to it agreed with a certain specification, or that the piece of apparatus submitted was one which met a standard specified.

Mr. Vernier said there were three classes of work that a proving house might do. First there was the general question of research, such as determining the carrying capacity of cables, then there was the approval of specific designs, and then the testing of materials, and there was a difficulty in drawing a line as to how far they were to go.

Mr. Turnbull, in reply, said the idea was not new; it had been tried in America, and there they had had so much experience that he did not think they would have much difficulty in getting to work here. He did not think they would get legislation before they got a proving house—that was to say, an approved authority.

OPERATING TEMPERATURES IN LARGE A.C. GENERATORS.

In an article in the *Electrical World* of March 30th on the above subject, Mr. H. D. Stephens says one of the chief causes of insulation failure is excessive temperature, and heretofore it has been a problem of determining when the prescribed temperature limit is exceeded. When thermometers were used for this purpose the insulation apparently failed in some cases before the temperature limit determined by laboratory test was exceeded. This apparent disagreement was really due to the fact that the thermometers were not placed where the maximum operating temperatures occurred.

It has been possible to determine the maximum operating temperatures much more effectively by the thermocouple or exploring coil, which can be installed where the hot spots are expected to occur. In fact, they have been found so effective that their use is becoming standardised in all large-size alternators having a core width of 20 in., and in all machines wound for 5,000 volts or over.

The exploring-coil type of detector consists of a coil of wire having a high resistance. Any change in resistance will be directly proportional to the temperature change; hence, if the resistance and corresponding temperature are known, the temperature can be readily calculated. The exploring-coil type of detector developed by the Westinghouse Electric and Manufacturing Co. consists of fine copper wire, is approximately 5 in. long, and has about 30 ohms resistance. The resistance is measured by a simple Wheatstone bridge arrangement in which the detector forms one of the four resistance arms.

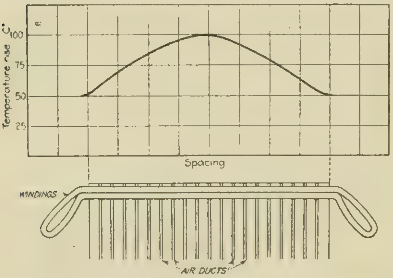

Fig. 1.—Temperature Variation along Armature Slot.

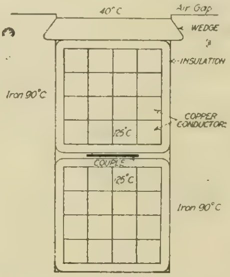

Fig. 2.—Best Location for Thermocouple to Detect Maximum Internal Temperature.

With this type of detector the readings will be absolutely accurate only when the temperature of the coil and leads is the same as that at which calibration took place. However, if the resistance of the coil is very high and the resistance of the leads relatively low, the percentage of error is very small indeed over the range of temperature found in practice. The fragility of the small exploring coil is its greatest drawback. If heavier wire were used for the coil, it would occupy more space in the slot, or the resistance would have to be made very much less. Further, even if only 5 in. in length, it measures an average temperature over this entire distance in the core. If the core is only 20 in. in width, the difference between the average and hot-spot temperature may be considerable, as the coil occupies 25 per cent. of the width. A large or longer coil will increase this percentage and render still greater the difference between the reading obtained and the actual "hot-spot" temperature.

The preceding disadvantages are absent with the thermocouple detector because the thermocouple registers the temperature at a single junction point, and it can be made of thin strong metal strips instead of very fine wire. The "hot" couple or junction point in the machine is at the point where the temperature is measured, and is connected to a "cold" couple in the temperature indicator. In the apparatus developed by one manufacturer this is a potentiometer of the galvanometer type arranged for switchboard mounting, and with the measuring scale calibrated to read directly in degrees Centigrade.

The temperature as indicated by either the exploring coil or the thermocouple is practically valueless as an indication of safe operating conditions unless the detectors are installed at the spots where the highest temperatures will occur. These spots are difficult to determine because the resultant temperature is due to several sources of heat, which may be widely different in different machines, even if of the same general type, especially when there is a change of load or terminal voltage.

In general, test data covering a large number of generators of different characteristics show the location of points of maximum temperature to be at or near the centre of the core and in the copper of the windings at this point. This is illustrated in fig. 1, which shows a temperature curve obtained by installing a number of detectors at various points across the machine, and all in the same armature slot.

The correct location for a detector in the armature slot is shown in fig. 2. Nearly all modern alternators have two-coil-per-slot windings. Therefore, if the copper has the highest temperature, any location except that between the two conductors gives a reading intermediate between the temperature of the copper and that of the iron, since the heat transfer from the hot to the cooler surface is accomplished only when a drop in temperature exists. When the two conductors in the same slot are at or near the same temperature, as they normally are, there is no tendency for heat transfer from one to the other, hence the detector at this point approximates the maximum temperature. Undoubtedly there are many large machines in service, equipped with temperature-indicating devices, whose temperature readings are absolutely valueless in so far as measurement of the "hottest spot" temperatures is concerned. This has been due to a lack of definite data on the subject.

Six thermocouples are ordinarily used per machine by the Westinghouse Electric & Manufacturing Co.; the couples are made of thin ribbons of copper and Advance alloy welded together. The individual copper leads are run from the terminal board of the machine to the switchboard. A common Advance alloy lead forms the other side of the circuit. This keeps the wiring to a minimum, and at the same time allows of reading on any one of the six couples employed. Where exploring coils are used the same wiring scheme as used for thermocouples will apply, except for the substitution of resistance coils for the couples and a standard type of voltmeter with scale marked and calibrated to read degrees Centigrade.

Both methods of measurement described are superior to the older thermometer method for machines having large ratings. The detector is useful at times of heavy load in furnishing the operator with data so that the safe temperature of the insulation may not be exceeded, and to check conditions of operation to predetermined loads.

Accumulations of dust and dirt in the air passages of the machine will, for a given load, cause the operating temperature to rise. The detectors will give indications as to when such conditions exist, and warn the operator to remedy them by cleaning the machine thoroughly. The use of detectors is not recommended for small-capacity machines, because such units are usually narrow of core, and have internal temperatures that differ but little from external accessible points. Furthermore, the armature slots are of such small proportions in these machines as to render the location of detectors either very difficult or impossible. Detectors cannot be used for measurement of temperatures of revolving fields of alternating-current generators, nor for revolving armatures of direct-current generators, because of the variable nature of the moving contacts and the large percentage of error that it would cause with such small values of current or voltage as are used in detector circuits.

WAR ITEMS.

A Reader's Appreciation.—A correspondent with the Royal Air Force in Egypt, who through a change in his department of "work" is now, to his delight, brought "into closer contact with matters electrical," says:—"Roll on the realisation of *the* big change for which we have hoped so long. Meanwhile, let me once more express my best thanks for what you are doing for us on service in keeping constantly in view what will be required of us all when this part of the strafe is finished."

The American Bosch Co.—It is announced from New York that the American Government has taken over the works of the Bosch Magneto Co. in the United States, and that in future the output of the factories will largely be used for American war purposes.

The Electrical Co., Ltd.—The Board of Trade has presented to the Court a petition for the winding up of this company. The petition is to be heard on May 28th. On the same day a similar petition is to be heard respecting the A.E.G. Electrical Co. of South Africa, Ltd.

Trading with the Enemy.—The "London Gazette" for May 17th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Brazil, Chile, Colombia, Greece, Guatemala, Hayti and Dominican Republics, Netherlands, Netherlands East Indies, Norway, Persia, Portuguese West Africa, Spain, Sweden, and Venezuela.

A Halifax Roll of Honour.—The Roll of Honour, bearing the names of 289 employés of the Halifax Corporation Tramways and Electricity Departments, was unveiled on Tuesday evening last week by the Deputy-Mayor (Ald. R. Hodgson), at the club rooms of the Tramwaymen's Social and Benevolent Society, in Town Hall Street East. Mr. W. M. Rogerson, who presided, mentioned that of the men who had gone to the Forces 37 had been killed in action, 10 were missing, 38 had returned to civilian employment on discharge, three had gained the Distinguished Conduct Medal, and four had received the Military Medal.

Appointments Board for Demobilised Professional Men.—The report of the Committee appointed to consider the resettlement of officers has been approved by the Minister of Reconstruction, and in accordance with its recommendations the Minister of Labour is proceeding to set up a department to be known as the "Appointments Department," in order to provide advice and assistance to officers and others requiring professional and business appointments on their return to civil life. The headquarters offices of the department will be at Gresham House, Old Broad Street, E.C. 2, and will be under the direction of Mr. C. H. McCall. The department will be represented in the provinces by branch offices.

The Professional and Business Register of the Ministry of Labour and the Officers' Technical Training Courses of the Ministry of Munitions will be merged in the new department. With it will be associated two Committees, one dealing with questions affecting appointments, and the other with questions of training. The former Committee will comprise representatives of the principal professional and business organisations, together with representatives of ex-officers and of the Government Departments concerned. Local committees similarly composed will be associated with the department's provincial offices. The Training Committee will be an inter-departmental committee jointly appointed by the Ministry of Labour and the Educational and other Departments interested, including the Board of Agriculture and Ministry of Pensions, and the chairman will be nominated by the Board of Education. It will contain representatives of the universities and other educational organisations, as well as representatives of commerce and industry. With the advice and assistance of these Committees the Department will endeavour to find suitable appointments of a professional and business character for ex-officers and others requiring them, and either directly, or through the Educational Departments, will also endeavour to arrange facilities for those who wish to undergo courses of instruction either of a general or technical character.—*Labour Gazette.*

Defence of the Realm Tramway Regulations.—The following Order has been made under the Defence of the Realm Act:—

"7BC. If in the case of any tramway undertaking carried on under statutory powers by a local authority it appears to the Board of Trade that it is necessary for the successful prosecution of the war that the undertaking should be carried on in an efficient manner, but that owing to circumstances arising out of the war it cannot be so carried on without either charging tolls, fares, and charges in excess of those which the local authority is authorised in any year to charge or without applying in aid of a deficiency in any year in the revenue of the undertaking, local rates, or funds which are not applicable to that purpose, the Board of Trade may by Order authorise the local authority to charge the local rates or funds with any such deficiency and to defray the deficiency thereout to such extent and subject to such conditions as may be specified by the Order, and may by such Order modify any local Act regulating the undertaking to such extent and during such period as appears to the Board necessary for the purpose aforesaid, or for the purpose of relieving the local authority from the obligation of making allowances for renewals or depreciation."

Exemption Applications.—Hastings Tribunal has given three months' exemption to A. Watson (Grade 3), a fitter with the Tramway Co.

At Colchester, the Essex Appeal Court refused a National Service appeal against exemption held by B. W. Southgate (41, Grade 2), electrician with Joslins, Ltd., of Colchester.

Kington (Herefordshire) Rural Tribunal has granted exemption until July 1st to F. W. Hextall (32, Grade 1), estate electrician.

Conditional exemption has been granted to R. Down (41), meter inspector with the Folkestone Electric Light Co.

The Ilfracombe Tribunal has refused further exemption to G. Dring, electrical engineer, appealed for by Mr. H. J. Stewart, manager of the Electric Light Co.

The Widnes Tribunal has granted three months' exemption to an electrician (21, Class A), the sole support of a widowed mother. He failed to enter the Flying Corps early in the war.

At Windermere, Mr. C. Walker, manager of the Electricity Supply Co., appealed for the retention of J. Thornborough (C 2), electrician. The National Service Representative did not press his opposition owing to the man's category, and the fact that the staff at the works was already sufficiently depleted. Three months' temporary exemption was granted.

At Canterbury, an appeal was made by S. Terry (29, A 1), electrician, St. Dunstan's, whose protection certificate had been withdrawn by the Munitions Area Recruiting Officer. It was stated that outside the Corporation electric light works he was the only qualified electrical engineer in the city. For the Military, it was contended that the Tribunal could not consider any question of certified occupation, only any ground of hardship. Mr. Terry's leave could be arranged, and he could easily resell his stock. For the appellant it was urged that the business could not be re-established later on. Three months were conceded.

At Chatham, the Tribunal dealt with 38 employés of the Tramway Co., the National Service Representative asking that their conditional exemption should be cancelled, letting them rely on their cards of protection. For the company it was stated that they objected on principle; if the men lost their exemption from the Tribunal, they would lose the right of appeal. The managing director, Mr. W. Jensen, said that he had repeatedly tried to find substitutes, but his efforts were unsuccessful and discouraging. The men sent to him by the Labour Exchange were absolutely unreliable as motormen. Men who had been wounded could not stand the strain, and wanted to sit down, and became giddy, and the company had to study the public. Two old drivers were now employed in barracks as messmen, and he had tried to get them back. It was decided that the exemptions should stand, and notice of appeal was given.

On a review, the Eastbourne Tribunal has cancelled conditional exemption held by J. E. Aldridge (B 2), cable foreman in the Corporation electricity works, and has substituted six months, with re-grading.

At Stratford-on-Avon, the National Service Representative appealed against exemption, subject to substitution, given to A. Baldwin (41, Grade 2), electrician to Mr. J. Fielden, Kineton. Capt. Wratislaw stated that a qualified substitute sent by the Labour Advisory Committee had been refused. Mr. Fielden stated that the substitute offered was in no way suitable, and if the Red Cross Hospital was to be carried on it was only reasonable that such a man as Baldwin should be retained to see to the lighting, &c. The Tribunal decided that a suitable substitute had not been offered, and they confirmed the exemption.

At Broadstairs, the Isle of Thanet Electric Traction Co., Ltd., appealed for a number of indispensable employés, and two were given conditional exemption, subject to substitution.

A review has been made of the case of A. C. Cooper (35, Class A), stoker, dynamo attendant, &c., at the Isle of Wight County Asylum. The engineer (Mr. Holt) said that he could not spare another man, and if the engines stopped there would be no electricity or water for the institution. He now had only six men instead of the normal staff of 14. A month was granted with a view to substitution.

At Worcester, the Tribunal has withdrawn a certificate of exemption held by J. Harris (40, A 1), public lamp attendant and emergency hand, engaged at the Corporation electricity works.

At Reigate, the East Surrey Traction Co. appealed for W. P. MacAlpine (38), electrician and fitter, and J. Godbold (33), driver, and, with the assent of the National Service Representative, each was given three months' temporary exemption.

An application was made to the Fulham Tribunal regarding the cancellation of a certificate of exemption granted to a steam boiler driver and electrician, aged 31, married, Grade 1, employed by Messrs. Wm. Whiteley, Ltd., West Kensington. Conditional exemption was granted in August, 1916, but the certificate was recently cancelled by the National Service Representative under the new Order. The Chairman inquired if the Tribunal had any power in the matter. The firm's representative contended that the certificate had not properly been cancelled, because, he submitted, the National Service Representative had no power to cancel it, the man concerned being the only one of his occupation in his shift. The Chairman said he failed to see how the case came under the new Order, but if it did the Tribunal had no jurisdiction. No action was taken.

Messrs. Marbro, Ltd., manufacturers of electrical switches, of Fulham, applied to the local Tribunal for the renewed exemption of Mr. W. A. Robertson, 39, married, the general manager and secretary of the company. It was stated that the company was formed in 1914 for the purpose of making certain electrical appliances which up to that time had been a German monopoly. Mr. Robertson was not only the manager, but the sole male employé, and was absolutely indispensable, the directorate being merely an advisory body. It was claimed that this was the only business of its kind in London. The Tribunal renewed the certificate for four months.

At the Shoreditch Tribunal, Messrs. Mortiz & Chambers, Ltd., of 89, Great Eastern Street, E.C., importers of electrical goods from Japan and America, appealed for Robert Lambert Chambers, aged 37 years, classed "A," governing director, for the fifth time. It was stated that they imported globes for electric lights under licence, space being allowed on board steamers according to their pre-war imports. Mr. Chambers managed the finance, in fact was the only one who could do so, as Mr. Moritz had had a paralytic stroke, and only came to the office occasionally, whilst Mr. Kipling, the other director, was only in a consultative position. Mr. Chambers and the family held stocks to the value of £9,000. The Tribunal decided to grant four months exemption.

LEGAL.

Tampering with Electricity Supply Wires.

At St. Augustine's Petty Sessions, recently, two youths, S. T. Davy and F. Anderson, were summoned for unlawfully and wilfully doing damage, injury, and spoil to and upon certain cable, the property of the Whitstable Electricity Supply Co., Ltd., to the amount of 1s., on May 1st. From the evidence it appears that on the date mentioned the electric light over a considerable part of the town went out at about 8.45 p.m. The places affected included the Military Hospital at Tankerton, where there was X-ray apparatus. The next morning the company was inundated with complaints, and there was a certain loss of revenue. There was alarm and apprehension among the public, who thought there was an air raid. Subsequent inquiries showed that a piece of wire had been thrown across the cable in Cromwell Road, at a place near to the residence of the defendant Davy. The boys were charged with throwing the wire upon the cable. It did not matter what their intention was, said the Supply Co., the effect was the thing. This was not an isolated case. The same sort of thing had happened both before and since May 1st, though it was not contended that these boys did it all. The company asked the Bench to put a stop to such proceedings. The Bench decided that there was no case against Anderson. The solicitor for Davy explained that the latter had a "little knowledge"—a "dangerous thing"—about electricity, and he wanted to produce a spark. He succeeded in doing so—produced a tremendous one. He and the other lads with him were then afraid of what had happened, and ran away. Davy denied doing it, but a police representative managed to entangle him and the other boys in their talk. Davy had now been sufficiently frightened. The Bench fined him 10s., including costs, and probably he has also been "dealt with" by father.

Electrical Engineer Fined.

At Sutton Coldfield, on Thursday last week, George Robert Coles, an electrical engineer, of Sutton Coldfield, was fined £10 for fraudulently consuming electricity, the property of the Corporation, within the last six months.

Mr. Thomas Bloore, the Corporation electrical engineer, said the defendant was using electricity freely. He went to his house on the 7th, and found that the wiring in the pantry, connected with the electric meter, was so arranged that the current supplied to the premises was not passing through the meter. Several alterations had been made to the electrical fittings of the house, and these had not been reported to the electrical department.

When asked for an explanation, **Defendant** stated that the wire fell out of the meter, and, in order to get a light, he had placed it in the opposite terminal, and had forgotten to report the matter.

TRADE STATISTICS OF BRAZIL.

The following figures show the imports into Brazil of electrical and similar goods during the year 1916. The figures for 1915 have been added for purposes of comparison, and notes of increases or decreases, as the case may be, are given :—

	Dollars. 1915.	Dollars. 1916.	Dollars. Inc. or dec.
Electric cable.—			
From United States	203,000	342,000	+ 139,000
,, Great Britain	1,000	9,000	+ 8,000
,, Other countries	5,000	5,000	—
Total	209,000	356,000	+ 147,000
Insulators.—			
From United States	24,000	53,000	+ 29,000
,, Great Britain	4,000	17,000	+ 13,000
,, Other countries	5,000	5,000	—
Total	33,000	75,000	+ 42,000
Other electrical machinery.—			
From United States	461,000	876,000	+ 415,000
,, Germany	22,000	—	– 22,000
,, Great Britain	137,000	128,000	– 9,000
,, France	29,000	37,000	+ 8,000
,, Other countries	42,000	85,000	+ 43,000
Total	691,000	1,126,000	+ 435,000
Electric motors.—			
From United States	40,000	42,000	+ 2,000
,, Germany	7,000	—	– 7,000
,, Great Britain	13,000	28,000	+ 15,000
,, Switzerland	5,000	40,000	+ 35,000
,, Other countries	14,000	13,000	– 1,000
Total	79,000	123,000	+ 44,000
Dynamos and electrical generators.—			
From United States	7,000	43,500	+ 36,500
,, Great Britain	18,000	7,000	– 11,000
,, Switzerland	6,000	26,000	+ 20,000
,, Other countries	9,000	6,500	– 2,500
Total	40,000	83,000	+ 43,000
Industrial machinery.—			
From United States	111,000	288,000	+ 177,000
,, Great Britain	361,000	315,000	– 46,000
,, Germany	13,000	—	– 13,000
,, France	19,000	54,000	+ 35,000
,, Other countries	47,000	101,000*	+ 54,000
Total	551,000	758,000	+ 207,000
* Sweden, $35,000.			
Lighting apparatus.—			
From United States	32,000	72,000	+ 40,000
,, Germany	6,000	—	– 6,000
,, Great Britain	23,000	18,000	– 5,000
,, Other countries	11,000	9,000	– 2,000
Total	72,000	99,000	+ 27,000
Other machinery (except textile and agricultural).—			
From United States	551,000	936,000	+ 385,000
,, Great Britain	371,000	331,000	– 40,000
,, Germany	37,000	—	– 37,000
,, France	123,000	97,000	– 26,000
,, Belgium	1,000	3,000	+ 2,000
,, Italy	21,000	21,000	—
,, Switzerland	37,000	82,000	+ 45,000
,, Holland	96,000	—	– 96,000
,, Other countries	92,000	132,000	+ 40,000
Total	1,329,000	1,602,000	+ 273,000
Motors, gasoline, kerosene, &c.—			
From United States	21,000	41,000	+ 20,000
,, Great Britain	5,000	8,000	+ 3,000
,, Switzerland	22,000	15,000	– 7,000
,, Other countries	9,000	150,000	+ 141,000
Total	57,000	214,000	+ 157,000
Steam engines.—			
From United States	2,000	2,000	—
,, Great Britain	1,000	11,000	+ 10,000
,, Other countries	2,000	4,000	+ 2,000
Total	5,000	17,000	+ 12,000
Motors, n.o.e.—			
From United States	23,000	40,000	+ 17,000
,, Great Britain	40,000	16,000	– 24,000
,, Sweden	14,000	19,000	+ 5,000
,, Switzerland	6,000	32,000	+ 26,000
,, Other countries	16,000	4,000	– 12,000
Total	99,000	111,000	+ 12,000
Telegraph and telephone posts, and bridge and fence material.—			
From United States	41,000	52,000	+ 11,000
,, Great Britain	91,000	73,000	– 18,000
,, Germany	1,000	—	– 1,000
,, Other countries	5,000	—	– 5,000
Total	138,000	125,000	– 13,000
Copper wire.—			
From United States	57,000	85,000	+ 28,000
,, Great Britain	8,000	8,000	—
,, Other countries	3,000	4,000	+ 1,000
Total	68,000	97,000	+ 29,000
Iron and steel wire.—			
From United States	607,000	1,633,000	+ 1,026,000
,, Germany	17,000	—	– 17,000
,, Great Britain	51,000	59,000	+ 8,000
,, Other countries	63,000	102,000	+ 39,000
Total	738,000	1,794,000	+ 1,056,000
Hydraulic pumps and accessories.—			
From United States	42,000	56,000	+ 14,000
,, Great Britain	25,000	11,000	– 14,000
,, Germany	5,000	—	– 5,000
,, Other countries	13,000	24,000	+ 11,000
Total	85,000	91,000	+ 6,000
Scientific instruments.—			
From United States	27,000	48,000	+ 21,000
,, Germany	11,000	—	– 11,000
,, France	9,000	20,000	+ 11,000
,, Great Britain	14,000	20,000	+ 6,000
,, Other countries	17,000	12,000	– 5,000
Total	78,000	100,000	+ 22,000
Electric lamps.—			
From United States	98,000	237,000	+ 139,000
,, Great Britain	17,000	14,000	– 3,000
,, Holland	48,000	40,000	– 8,000
,, Other countries	33,000	21,000	– 12,000
Total	196,000	312,000	+ 116,000

BUSINESS NOTES.

Dinner. — The Telephone Assembly Section of the Apparatus Department of Siemens Bros. & Co., Ltd., Charlton, held a dinner at Woolwich, last Saturday week, at which a proposal was put forward for forming an association to promote social intercourse. It was intended to present £15 to an employé who had suffered a long illness, but she was not able to be present.

Aluminium in Austria-Hungary. — It was recently reported from Vienna that the Austrian Government had acquired boring rights relating to large districts in the Istrian peninsula and Dalmatia, and intended to open up the deposits of bauxite there ascertained by geologists to exist. On the other hand, it was said that a scheme was being promoted in Dalmatia to establish a large aluminium works, in the constitution of which, besides three Vienna banks, the German Berndorf Metal-ware Works, the firm of Krupp, and the Kerka Hydraulic Co. were to participate. It is now stated that negotiations in regard to the formation of a large private aluminium works in the district of Bihar (Hungary) have failed to mature. The Government consequently intends to proceed with the erection of the works, with a slight participation of private capital, at an expenditure of from £1,250,000 to £1,666,000.

Liquidations.—British Adding Machine Co., Ltd.—Meeting, June 21st, at 1 and 2, Great Winchester Street, E.C., to hear an account of the winding-up from R. L. Sare, liquidator.

"Electrician" Printing and Publishing Co., Ltd., London.—Voluntary liquidation, with Mr. E. C. Elliott, 4 and 6, Throgmorton Avenue, E.C. 2, as liquidator. The business, it will be remembered, was taken over by Messrs. Benn Bros., Ltd.

Elieson Electric Traction Co., Ltd.—As the company is unable to pay its debts, &c., it is winding up voluntarily, with Mr. J. T. Lillhardt as liquidator. Meeting of creditors May 30th, at 25, Finsbury Square, E.C.

Auxiliary Electrical Co., Ltd.—Meeting at Salisbury House, London Wall, E.C., July 1st, to hear an account of the winding up from the liquidator, Mr. F. R. Reeves.

Japan and Australian Trade. — Prof. Murdoch, of Sydney University, thinks it likely that large numbers of young Japanese who went abroad, mainly to America, to study trade, will be attracted to Australia.

Book Notices.—"The Year-Book of Wireless Telegraphy and Telephony, 1918." lxxxiv + 1,154 pp. London: The Wireless Press, Ltd. Price 6s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LVI. May, 1918. No. 274.—The May issue contains the following paper:—"The Control of Large Amounts of Power," by Mr. E. B. Wedmore. Also Report of the Council for 1917-18, and the annual and Benevolent Fund accounts for 1917.

Decimal Money Tables. By A. M. Pooley. London: Syren and Shipping, Ltd. Price 2s. 6d. net.—This set of decimal exchange tables, covering the conversion of British sterling from and into any foreign money at any rate of exchange, and to any amount, has been published in past years as a section of the *International Mercantile Diary and Year Book* issued by "The Syren and Shipping"; in view of the expected adoption of decimal coinage, the tables are now published in separate form. They are very complete and comprehensive, and even under existing conditions will be found of great use; many firms have already adopted the practice of keeping their books in decimalised pounds, and have derived considerable advantages therefrom, and these tables greatly facilitate the process of conversion for this purpose. They are clearly printed and conveniently arranged, and are carried out to a degree of accuracy ample for all purposes.

Bankruptcy Proceedings.—R. E. Connold, late electrician, now R.N.A.S., Canterbury.—Application for discharge, to be heard June 11th, at Canterbury.

Trade Announcements.—The Tudor Accumulator Co., Ltd., have disposed of their rail-welding business to the managing director (Mr. Edwin Jacob), who is continuing the business on his own account, with the same experienced engineering staff, as the Rail-Welding Co., at 119, Victoria Street, S.W. 1, and will attend to debts, &c. Mr. Jacob will continue as managing director of the Tudor Accumulator Co., Ltd.

Mr. Joseph Oxley has removed his head office from Vicar Lane to Cadman Chambers, Norfolk Street, Sheffield.

The Government having temporarily requisitioned the Caxton House offices of Brunner, Mond & Co., Ltd., their address is now 82, Victoria Street, S.W. 1.

Cooking Apparatus Prices.—Messrs. Belling & Co. announce that as from May 16th their list prices are subject to an increase of 50 per cent., with the exception of their electric fires, which are advanced by 33⅓ per cent.

LIGHTING AND POWER NOTES.

Accrington.—Year's Working.—The accounts of the Corporation electricity department for 1916-17 showed a loss of £10,155, but in the year just ended this deficit has been turned into a profit of £2,169. The installation of a steam turbine, with a resulting economy in the cost of production, a considerable saving in the consumption of coal, and the increase in electricity charges have been the chief factors. At the beginning of the last financial year there was a total deficiency on the department of £14,521, the result of losses in previous years, which was temporarily provided for by contributions from sums in hand in connection with the general district fund and contributions from the rates, leaving a deficiency of £2,661, which is reduced by this year's profit to £491.

Australia.—Price Increase.—The Melbourne City Council has decided to increase the charges for electricity for lighting as follows:—4d. per unit for the first 50 units consumed per month, 3½d. per unit for the next 1,000 units, 3d. per unit for the next 1,000 units, and 2d. per unit for the remainder of the units consumed per month; for power in excess of 5,000 units per month, an additional monthly charge of 0·045d. per unit for every 2s. 6d. increase above 20s. per ton in the average price of coal delivered.

Sydney City Council decided that, owing to the generating plant being loaded to its full capacity, no new consumers would be connected after the end of March. The Council has arranged to obtain a limited supply of electricity from the Government tramway power house at White Bay, but until converting plant is installed this cannot be taken advantage of. The converting plant is expected to be in operation by September 1st.—*Tenders.*

Surplus Power.—The question of the disposal of the surplus power from the Victorian Railway Commissioners' Newport power station has been satisfactorily settled. The Melbourne City Council and the Melbourne Electricity Supply Co. have agreed to an arrangement under which the Commissioners will supply electricity to Footscray (including Footscray tramways), Williamstown, and the neighbouring districts. Any surplus power will be at the disposal of the Melbourne City Council and the Electric Supply Co.; under the original proposal, the Commissioners were not restricted as to area.—*Tenders.*

Electric Steel Production.—The Sydney City Council Electric Lighting Committee, says *Tenders*, has received a report from the city electrical engineer with reference to the inquiry from the Commonwealth Steel Products Co. as to on what terms and hours the Corporation would supply power for electric steel production. The engineer states that the company has now completed an arrangement by which its works will be established in Newcastle, and will get its supply of electricity from the Railway Commissioners' power house at Newcastle; this is regrettable, as the electric light department of the Council has lost a valuable customer, who would eventually have become highly profitable; secondly, the industry of making steel in electric furnaces, which might have been established in Sydney to the profit of the Sydney community, will now probably be permanently established in Newcastle; also, as a result of the arrangement made between the Steel Co. and the Railway Commissioners, one of the large turbo-alternators from White Bay will be moved to Newcastle, and this must greatly reduce the surplus electricity which the Commissioners might have supplied to the City Council, and which the Council might have used for the next few years, until the Council's new generating plant was installed.

Bury St. Edmunds. — Messrs. Boby, Ltd., having declined the offer of the T.C. to supply power and lighting at 2d. per unit for a consumption of 150,000 units per annum for five years certain, the Corporation has decided that it cannot see its way to make any further concession. The engineer had suggested a final offer of 1¾d. per unit.

Continental.—Spain.—In order to meet the increasing demand for electricity, the Sociedad Electra Valenciana, of Valencia, has recently added 3½ miles to its low-tension mains and nearly 2 miles to the high-tension system, bringing the totals up to 45 and 11 miles respectively. Three new transformer stations have lately been established in the town, and six more are shortly to be provided. At the present time the company is supplying energy to 14,400 consumers.

Derbyshire. — Linking-up Scheme. — A meeting of representatives of the coal, iron, and steel industries of Notts. and Derbyshire was held on Saturday, at Mansfield, to discuss the Government proposals for the unification of electrical supply in the Notts. and Derbyshire district, and to consider the advisability of linking-up with the South Yorkshire scheme. Mr. A. B. Gridley, the chief electrical officer of the Ministry of Munitions, attended, and addressed the meeting, and subsequently a Committee was elected to present a scheme of electric supply for the district similar to that adopted by the Nottingham Corporation. It was also decided to engage an expert to present a report on the matter.

Edinburgh.—A number of resolutions have been adopted by the Corporation Electric Lighting Committee, among which are several dealing with the existing arrangements for the generation and distribution of electric power supply in the country. It was suggested that when the areas for the super-stations were decided upon Edinburgh should be one, and that the power should be supplied from the Portobello station. The necessity of the erection of the new Portobello station being proceeded with was also emphasised. These resolutions will come before the Council, which will be asked to appoint a deputation to go to London and press upon the authorities the urgency of the matter.

Fleetwood.—Year's Working.—The electricity undertaking of the U.D.C. for the past year shows a deficit of £2,181, notwithstanding the increased charges for energy. The expenditure has been £9,376 and the income £7,195.

Galway.—The Electric Light Co. has intimated to the U.C. that it does not propose to offer its works for sale as had been assumed in a recent discussion.

Grimsby.—War Bonus.—Having refused an additional war bonus to the clerical staffs, the Corporation Electric Lighting Committee has received notice from the National Union of Clerks that, in view of the 12½ per cent. award upon earnings, they have applied for the matter to be referred to arbitration.

Harrogate.—Year's Working.—The financial statement for the past year shows that the income of the electricity department, after allowing for capital charges to revenue and reserve, was £757 better than the estimate.

Huddersfield.—Price Increase.—The Electricity Committee has decided that the charges for energy for power and lighting to ordinary consumers shall be increased from 25 per cent. to 37½ per cent. above pre-war charges.

Hull.—Wages.—The Electricity Committee has had a request for an increase of wages from the girls employed in reading meters and other girls at the power station. The acting engineer (Mr. McGoris) stated that the girls did not work the same hours, nor do the same work as the men, and they were paid 26s. a week plus the bonus. The request was not entertained.

Breakdown.—The firing of a fuse-box on the Holderness Road caused a partial breakdown in the electric supply in East Hull, on Whit Monday. The Holderness Road tramcars and also the supply to private houses and at the East Hull places of amusement were involved. A Corporation employé who opened a street fuse-box was burned about the hands and face, and required treatment at the infirmary.

London.—Shoreditch.—Bulk Supply.—The Electricity Committee reports that the existing agreement for a bulk supply of electricity from the Stepney B.C. Electricity Department expired last September, but the supply has been continued, subject to the terms being revised. As the result of the conference between the respective borough electrical engineers, the Stepney B.C. has intimated its willingness to continue the bulk supply until the end of September, 1918, on the same terms, with the exception that the charge per kw. be increased by 5s. per kw. The Committee recommends that, subject to the consent of the B. of T., the offer be accepted.

Lambeth.—Street Lighting.—The B.C. has decided to request the Home Office to consider the question of a further reduction in street lighting during the summer months, and has invited the other Metropolitan Borough Councils to take similar action. The Public Lighting Committee was requested by the Council to consider the advisability of not lighting the public lamps in certain streets during the summer months, but it found it could take no action, as the question of street lighting was now entirely in the hands of the Home Office.

Musselburgh.—Price Increase.—The T.C. has authorised the Electric Light and Traction Co. to increase its charge for domestic electric lighting from 5d. to 7d. per unit for the duration of the war, and a reasonable period thereafter.

Nelson.—Wages.—The Electricity and Tramways Committee has declined to grant an application by the Burnley and District Joint Engineering Trades Societies for improved working conditions and increases of wages for certain employés in the electricity department.

Newport (I. of W.).—Price Increase.—The T.C. has decided to withdraw opposition to the application from the E.L. Co. to increase the maximum price of energy to 9d. per unit, on the company agreeing not to charge any consumer higher than 8d. without the consent of the Corporation.

Rawtenstall.—Bulk Supply.—As the result of a conference, last week, between representatives of the Bacup and Rawtenstall Corporations, a satisfactory agreement was arrived at with respect to the terms for the supply of electricity in bulk by Rawtenstall to Bacup for the current period of five years, concerning which serious differences had arisen.

Spenborough.—Year's Working.—There is an estimated loss on the Council's electricity undertaking of £1,000, requiring a subsidy of a 2d. rate.

Stafford.—Year's Working.—A balance of £3,542 on last year's accounts of the Corporation undertaking has been absorbed in the payment of loan charges and income-tax, except for £100 transferred to reserve.

South Africa. — Johannesburg. — According to the *Globe*, the electricians' strike has ended, the Council having conceded the power station engineers' demand for £8 2s. weekly, an increase of 12s. per week.

TRAMWAY AND RAILWAY NOTES.

Belfast.—12½ per cent. Bonus.—The impasse created in the Corporation's tramway service by the opposed requirements of the "Aberdeen Clause" in the Act of 1904, under which the system was acquired from private owners, and the 12½ per cent. award given the employés, seems to be solved, the Government having taken steps to release the Corporation from the obligations imposed upon it by the "Aberdeen Clause," which compels the tramways to be self-supporting. The Corporation found itself in the extraordinary position that if it failed to enforce the clause it broke the law; if it failed to enforce the law it broke the award—in either case a very serious matter for it. The revenue returns show that with the maximum fares in force, and the cutting down of expense in every way and the reduction of the service, there is still a deficit of over £20,000 to be met. With the increased wages of 12½ per cent., there is a deficit of over £56,000 to be met, and with the "Aberdeen Clause" abrogated there will still be a deficit of £32,000 to be met by the ratepayers, who in return have a worse service, and last week were threatened with a total shut down of the system. This would have been a serious matter, as over 56,000 workmen engaged in national work are conveyed daily to the various shipbuilding yards, &c. The employés are on notice, which will expire on the 23rd inst. Last Saturday the cases, which involve 880 employés, were again heard by the Munitions Tribunal, and adjourned till the 29th inst., on the understanding that the arrears accruing under the award will be paid to the men by the end of this month.

Blackpool.—Annual Estimates.—Having considered its estimates for the current year, and in view of further restrictions on traffic by the Government, the Tramway Committee estimates that the net profit will be £15,000, as compared with an actual profit of £31,518 for the year just ended. The estimated income is £100,000 (as against £119,339 for the past year), and the estimated expenditure £65,500 (being £3,000 less than the actual expenditure for the past year), leaving a gross profit of £34,500 (as compared with £50,883 for the past year).

Bolton.—Sunday Services.—The Corporation proposes commencing the Sunday tramway service at 1.30 p.m., instead of 12 noon, and also to curtail the week-night service. Southport Corporation has decided not to run cars before 2 p.m. on Sundays.

Continental.—Sweden.—The Swedish Postal Authorities are about to make some trials of an electric motor delivery van in connection with the collection and delivery of letters.

Edinburgh.—Prov. Order.—The Corporation has made application to the Secretary for Scotland for a prov. order to construct new tramways and to reconstruct existing tramways for working by electricity or other mechanical power.

Tramway Managership.—The Tramway Committee has decided, in view of the taking over of the tramways by the Corporation, that it is desirable to appoint a manager, at a salary of about £1,000 per annum.

Edgware and Hampstead Railway.—The B. of T. has extended for one year the time for the completion of certain works, purchase of land, &c., in connection with the construction of this railway.

Huddersfield.—Year's Working.—The total income of the tramway undertaking for the year ending March 31st last amounted to £174,292, as compared with £152,436 last year. The surplus amounted to £7,462, as against £9,844 for the previous year, £6,750 being allocated to the relief of the rates, and £712 transferred to the reserve and renewals account, which now amounts to £60,692.

Leeds.—Parcels Service.—The tramway parcel carrying department, recently established, is to be considerably extended very shortly, and it is stated that traders are to be offered a special inducement to use the system by an arrangement of a 5 per cent. discount on parcel stamp purchases in lots of £5 or over, and, where desired, monthly accounts may be opened.

London. — Women Conductors.—According to the *Tramway and Railway World*, Mr. L. E. Harvey, general manager of the Ilford Tramways, has been notified by the Commissioner of Police that all inquiries as to women applicants for tramway car conductors' licences should be made by the police instead of by the tramway officials. It appears that in September, 1915, when women conductors were first employed, the Chief Commissioner of Police agreed with all the managers of the metropolitan tramways that the latter should make all inquiries as to character, age, &c., and that on the manager's certificate the police would issue a licence. Now, for no stated reason, this arrangement has been rescinded, after having worked satisfactorily for nearly 2½ years. Mr. Harvey has addressed a letter of protest to the Commissioner, pointing out that there was no reason for the alteration, and that, bearing in mind the considerable extra duties of the police at the present time, the proposed arrangement would greatly delay the issue of licences.

Mexico.—The company owning the electric street car system of Mexico City and its suburbs has established a Committee of Justice, before which all persons having complaints against employés of the lines are invited to appear and present their charges. Several hundred such cases have already arisen, and the findings of the Committee are enforced by the company. There are over 3,000 employés on the various lines of the system.

Nelson.—Fare Revision. — At the T.C. meeting, last week, Mr. W. F. Cooke, chairman of the Electricity and Tramways Committee, in referring to the decision of the Committee to abolish ½d. fares, stated that the Committee was paying more than £1,150 in wages over what was paid before the war, and for the ensuing year it was faced with an additional advance, which meant another £1,000. Nelson, he added, was the last borough in the whole of England to abolish ½d. fares.

Padiham.—The U.D.C. has decided that a report be prepared upon the position of the Council with respect to the tramways within the urban district, and submitted to a special meeting of the General Purposes Committee.

Preston.—Workmen's Fares.—The Corporation proposes discontinuing the present workmen's fares, and to charge workmen single fare for return journeys.

TELEGRAPH AND TELEPHONE NOTES.

Holland.—Java and Holland are now in communication by wireless over a distance of 10,000 miles. The station at Bandoeng, Java, is transmitting 5,000 words daily to Scheveningen, near The Hague. It is 2,800 ft. above sea level.—*T. and T. Age.*

Rumania.—According to a Reuter telegram, referring to the fact that Germany, under the peace treaty, has assured to herself possession of the telegraph lines, wireless installations, and cable system on the Rumanian coast, the *Reichspost* says that these measures are connected with a plan for a big German intelligence service after the war, particularly in the wireless domain.

Germany has secured permanent telegraphic communication with Turkey *via* Rumania, the right to make the fullest use of all telegraphs in Rumania, and, until the year 1950, a cable station on what remains of the Rumanian coast.—*The Times.*

Sweden.—According to advices from Stockholm, the Swedish Telegraph Administration has made representations to the Government with regard to the reorganisation of the radio-telegraph service, especially in the matter of installations on mercantile ships. Hitherto the shipowners have been compelled to apply to the international company—the Société Anonyme de Télégraphie sans Fil of Brussels—which is said to be the owner of the working rights for Sweden of both the Telefunken and the Marconi systems. The tendency of this company is declared to lie in the direction of endeavouring to bind the shipowners also for the future when the patents expire, so as to be able to retain its monopoly in this respect. The Telegraph Administration considers that the letting out on hire of ship installations should be taken over by the Administration, and after negotiations with the Elektriska Aktie Bolaget A.E.G. of Stockholm, which represents the licensee company mentioned, has entered into an agreement for the delivery of 0·5-kw. installations on the Telefunken system for the account of the Telegraph Administration. The Administration intends to invite Swedish shipowners to subscribe for such installations in the same manner as in the case of telephone exchanges. Stations for ocean-going vessels, with plants of from 1 to 2 kw., will be dealt with later.

Wireless Strike.—The wireless operators are threatening to strike if their wages grievances are not remedied.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Brisbane.—July 1st. Treasury. Steam-driven turbo-alternators, boilers, and boiler-house equipment for the Inkerman irrigation area near Townsville, N. Queensland. Under-Secretary, the Treasury, Brisbane.

Melbourne.—July 3rd. Victorian Railways Department. Electric meters for power circuits. Chief Storekeeper, Railway Offices, Spencer Street.

Belfast.—May 31st. Electricity Department. 9,000 yd. of 6-core 0·1 sq. in. lead-covered, paper-insulated cable and laying. See "Official Notices" to-day.

Erith.—Electricity and Tramways Department. 500-kw. rotary converter with transformers, switchgear, &c. See "Official Notices" May 18th.

London.—Islington.—May 24th. Lighting Committee. 5,000-kw. turbine, alternator, exciter, condensing plant, switchgear, piping, &c., water-tube boiler, coal conveyer, telpher, burners, steam piping, &c. See "Official Notices" April 19th.

Newcastle-under-Lyme.—Electricity Department. One 150-kw. rotary or motor-converter set and switchgear. See "Official Notices" to-day.

Manchester.—May 28th. Electricity Committee. Stores for 12 months. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

CLOSED.

Barnes.—U.D.C. Tenders accepted:—

Cable.—Henley's Telegraph Works Co., Ltd.
Stoneware ducts.—Doulton & Co., Ltd.

Government Contracts.—List of new contracts placed in April, 1918:—

War Office.

X-ray apparatus.—F. E. Butt & Co., Ltd.; Cavendish Electrical Co., Ltd.; H. W. Cox & Co., Ltd.; Medical Supply Association; Schall & Son; Watson & Sons (Electro-Medical) Ltd.
Dynamos.—Electric Construction Co., Ltd.
Electric lighting sets.—Robey & Co., Ltd.
Generating sets.—Austin Motor Co., Ltd.; F. S. Bennett, Ltd.; H. T. Boothroyd, Ltd.; British Westinghouse E. & M. Co., Ltd.; Buffalo Forge Co., Ltd.; H. Green & Co.; J. H. Holmes & Co.; R. A. Lester and Co., Ltd.; Lyon & Wrench, Ltd.; New Pelaphone Engine Co., Ltd.
Motors and parts.—British Westinghouse E. & M. Co., Ltd.; Electric Construction Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.
Switchboards.—Dorman & Smith; J. H. Tucker & Co.
Insulating tape.—B. I. & Helsby Cables Ltd.; India-Rubber & Gutta-Percha Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros & Co., Ltd.; A. Terry & Co.
Transformers.—Brush Electrical Engineering Co., Ltd.

India Office, Stores Department.

Cells.—Pritchett & Gold, &c., Co., Ltd.
Generating sets.—Lancashire Dynamo, &c., Co., Ltd.

H.M. Office of Works.

Engineering services, spare parts for conveying plant, grain stores. H. Simon, Ltd.
National Physical Laboratory.—New aero-dynamics building.
Electric storage battery.—Pritchett & Gold Electric Power Storage Co., Ltd.

Post Office.

Telegraph apparatus.—Automatic Telephone Manufacturing Co., Ltd.; India-Rubber & Gutta-Percha Telegraph Works Co., Ltd.; Telegraph Condenser Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.
Testing apparatus.—India-Rubber & Gutta-Percha Telegraph Works, Co., Limited.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph and telephone cable.—B. I. & Helsby Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—B. I. & Helsby Cables, Ltd.; Siemens Bros. & Co., Ltd; Western Electric Co., Ltd.
Plug covers.—Spauldings, Ltd.
Insulator spindles and rod stays.—Bullers, Ltd.
Stay swivels.—Guest, Keen & Nettlefolds, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Limited).
Bronze wire, insulated.—B. I. & Helsby Cables, Ltd.
Annealed copper wire.—Shropshire Iron Co., Ltd.
Copper strand wire.—B. I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.)
Galvanized iron wire.—Dorman Long & Co., Ltd.; R. Johnson & Nephew, Ltd.; Rylands Bros. Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co.; Wire Manufacturers, Ltd.

FORTHCOMING EVENTS.

Royal Society of Arts.—Wednesday, May 29th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "Organic Chemistry in Relation to Industry," by Dr. M. O. Forster, F.R.S.

Institution of Electrical Engineers.—Thursday, May 30th. At 6 p.m. At the Institution of Civil Engineers. Annual general meeting.

Junior Institution of Engineers.—Friday, May 31st. At 7.30 p.m. At 39, Victoria Street, S.W. Final informal discussion evening of the session.

(**North-Eastern Section.**)—Tuesday, May 28th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "Lighting Phenomena," by Mr. S. A. Stigant.

Salford Technical and Engineering Association.—Saturday, June 1st. Visit to Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton.

NOTES.

Foreign Languages and Trade.—The following letter arrived while we were going to press:

"Your excellent leader of the 17th inst. establishes the importance of a knowledge of foreign languages in the approaching commercial struggle for overseas trade.

"Should we not, at the same time, appreciate that while there are very many languages of speech there are now substantially only two languages of quantity—viz., our own and the metric system?

"For many years past we have been obliged to employ the metric system to an ever-increasing extent in our export trade, and we thus hamper ourselves by continuing the use of our own obsolete system, because we are thereby employing two languages of quantity when one—the international metric system—would suffice for all purposes.

"In the recently issued report by the Committee on Commercial and Industrial Policy after the War, the statement is made that if we now adopted the metric system we should be required to work in two systems *for a generation*, but, even assuming this were true, it appears to me much less appalling than our alternative prospect of employing two systems *for all time*.

"Harry Allcock.

"Manchester, *May 21st*, 1918."

Restrictions in the Use of Gas and Electricity.—All communications on the subject of the restrictions in the use of gas and electricity should be addressed to Mr. Graham Roper, C.B., assistant secretary to the Board of Trade, 7, Whitehall Gardens, London, S.W. 1.

Economic Policy.—It is the intention of the Chancellor of the Exchequer to make a general statement shortly on the progress made by the Allies in carrying out the policy agreed to in the Paris Economic Conference resolutions.

The Value of "*g*" in Engineering and Physical Work.—The effect of variations in the intensity of gravity is very often discussed, but the exact magnitude of the effect and the complete method of taking account of it are never given except in inaccessible treatises. In an article by Dr. Sandford A. Moss in the *General Electric Review* (May, 1918, Vol. XXI, No. 5), the author has collected the data on the matter, and arranged them in convenient shape so that the exact magnitude of the variation is easily seen, and the cases where corrections are necessary are easily found. The data for making the corrections when they are necessary are also worked up in a form which is very much more convenient for actual use than has ever been given before. It is proposed that each laboratory shall work up, once for all, its correction factor for reducing force measurements, &c., to the standard "*g*" from the data which are given, and thereafter use the factor in experimental work, or not, according to the degree of precision desired. The author, while compiling the article, collaborated with the U.S. Coast and Geodetic Survey officials and with Prof. E. V. Huntington, of Harvard, who is a recognised authority on the subject. The data given may, therefore, be considered authoritative.

For Sale.—Leeds Corporation Tramways Committee invites offers for one 15-ton hand-operated overhead travelling crane. Particulars are given in our advertisement pages to-day.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending June 1st, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Capt. W. Hynam.

Monday, May 27th.—No. 3 Company, 6.30—8.30. Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, May 28th.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, May 29th.—No. 1 Company, Entrenchments, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, May 30th.—No. 2 Company, Entrenchments, &c., 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. Band Practice, 7.

Friday, May 31st.—Musketry for the whole Corps, 5.30—8.

Saturday, June 1st.—Knotting, lashing, &c., for the whole Corps, 2.45—4.45. Musketry, 2.45—4.45.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Fires in Germany.—According to the *Petit Parisien*, there was an epidemic of fires in Germany on Saturday last, including a big outbreak in the works of Siemens-Schuckert in Berlin.

Maintenance of Turbo-Alternators.—Mr. L. Fokes gives some helpful hints and advice on the above subject in the *Colliery Guardian* of April 12th, and particularly with regard to the dismantling of generators for cleaning purposes, he remarks that, in spite of filters, either wet or dry, it is impossible to prevent dust accumulating inside generating plant. It gets there in various ways. Some dust is made by the machine itself—probably from the insulation of the windings. A little gets through the filter, and a much larger quantity is drawn in through the openings for the rotor shaft in the end shields of the generator. The idea that a filter removes all necessity for cleaning generators is quite wrong, and end shields should be regularly removed in order to clean down and varnish the end windings, and also to see if oil or other matter is finding its way into the machine.

Many of the ducts through which the ventilating air has to pass are at right angles to the axis of the machine. It is very difficult to get at these ducts for cleaning, unless a machine is completely dismantled and the rotor removed. This entails a good deal of work, but it ought to be carried out once in three or four years, depending on the conditions noticed when the end shields of the machine are removed.

The removal of the rotor is an operation requiring great care throughout the whole operation, especially in withdrawing it from inside the stator, as the laminated cores of the rotor and stator will not slide one over the other without displacing the core plates and probably driving some into the winding tubes.

When dismantling becomes necessary for cleaning purposes, the generator coupling should be disengaged from the turbine, and the bearing covers removed on either side of the generator. A large sheet of ⅛-in. iron should be obtained, about 18 in. or 2 ft. wide, and long enough to project slightly over each end of the rotor. The sheet should be curved exactly to the shape of the inside of the generator stator.

After removing the end shields, the sheet of iron should be introduced between the top of the rotor and the stator, and, while held at each end, should be carefully worked down on one side of the rotor until it lies on the bottom half of the stator and under the rotor. After removing the holding-down bolts of the generator and dismantling the exciter field, a lift should be taken by slings fastened to the stator. As the stator is lifted, the rotor comes to rest on the iron sheet, and the whole is lifted by the crane into a suitable position for removing the rotor.

Having placed the whole machine on suitable packing, the crane should be fastened to one end of the rotor shaft, while a strong trestle is placed under the opposite end, so that a large pole may be used as a lever to ease that end of the rotor upwards as the crane lifts and travels slightly away from the stator, pulling the rotor with it in easy stages.

The iron sheet either travels with the rotor or the latter slides on it, which is immaterial, as in any case the iron readily slides over the surface of either without catching the laminations. When the rotor is half way out, the end of the shaft should be packed up and a final hitch taken round the centre of the rotor by steel slings, under which strips of hard wood, a few inches wide, should be placed to prevent the slings pulling into the air ducts of the rotor and damaging the plates.

While the machine is apart, all air ducts should receive special attention, being thoroughly cleaned by compressed air after all the dust and dirt has been loosened by a brush or other suitable means. It is an advantage after all dirt and dust is removed to spray one thin coat of varnish over the exposed tubes and sides of the slots, as smooth surfaces do not hold the dust nearly so readily as rough surfaces do. Special attention should be given to the bottom half of the stator, as the slots at this point become blocked more quickly than at any other part.

The replacing of the rotor is simply carried out by reversing the operations of removal. The iron sheet is placed in the bottom of the stator before introducing the rotor, and when the machine is in place and the rotor resting in its bearings, the sheet may be removed by working it up to the top of the rotor and withdrawing it. The insertion and withdrawal of the iron sheet at the top part of the machine is necessitated by the bearings, &c., being in the way of introducing or removing it from the bottom.

Referring to slip rings, the author points out that many will have noticed that one of the slip rings on a turbo-alternator wears much more quickly than the other. This wear is often very rapid when the rings are made of soft metal, although it still takes place even when steel rings are used. The current which supplies the excitation of the field is, of course, fed into the rotor by means of one slip ring, while it leaves the rotor by the other ring, and it will be found that the ring conveying the current from the rotor is the one which wears most. There appears to be some chemical action, assisted by the passage of the current from the ring to the brushes, which deposits copper (if the rings are of that metal) upon the brushes, and this in turn may play some part in the rapid wear of the slip rings through the metallic coating impairing the lubricating properties of the contact surfaces. Slip rings are usually difficult to renew, and it is a good plan to change over the leads of the generator field periodically, so that the polarity of the current is changed with reference to the respective rings.

As a result of this practice the rings both wear equally, and their combined life is nearly doubled. The ring surfaces should be kept as true as possible, and any uneven patches should be turned off immediately they appear.

Electricity for Wounded Soldiers.—An electrical apparatus which totally numbs the severest nerve pains, while at the same time gradually bringing about a permanent cure, a machine which will cure acute "water on the knee" in one 20-minute "exposure," and another which charges the patient up like a storage battery, are a few of the wonders of the Radcliffe Infirmary for wounded soldiers at Oxford. The problem of how to exercise electricity on paralysed muscles without unduly stimulating the healthy ones, has been solved by means of a newly-perfected system of condensers, which causes the injured muscles slowly to contract and relax, while the healthy ones remain quiescent.—*Journal of Electricity.*

Fatality.—An inquest has been held into the death of William Lovell, aged 14, a probationary fitter employed by the Avonside Engineering Co., Fishponds, Bristol. He was found dead in a travelling crane at the Avonside works, on a Sunday morning, having apparently been there since the previous afternoon. Dr. Harry Grey, who made a post-mortem examination, attributed death to collapse following congestion of the lungs, and said there was no indication of electric shock. A subsequent examination revealed a mark, which resembled a burn, on the right hand, and although this did not alter Dr. Grey's conclusions, the jury asked for further medical evidence. This was forthcoming when the City Coroner (Mr. A. E. Barker) resumed the inquiry, at the Coroner's Court, on Thursday last week. Dr. Grey added to his previous statement that he did not know on the former occasion that there were live wires which the boy could have touched. He was, however, still of opinion that death was due to congestion of the lungs, and not to electric shock. Dr. E. V. Foss said that the mark on the right hand was evidently a burn, but he could not say how it was inflicted. He was unable to give an opinion as to the cause of death. The appearances noted by observers in cases of electric shock differed, and it was possible that in this case death was due to shock. Dr. J. S. Mather said that it seemed quite possible that the lad received a shock, and the position in which the body was found was that in which he would have expected it to be if there had been contact with the wires. The jury returned a verdict of "Accidentally electrocuted."

Pulverised Fuel.—In a series of articles appearing in the *General Electric Review* under the heading "Methods for More Efficiently Utilising Our Fuel Resources," by Mr. F. P. Coffin, the current issue contains Part XVII, dealing with the extent of the use of pulverised fuel in the industries and its possibilities in the war. The article is presented in two sections; the first section briefly summarises the advantages of pulverised coal, treats of the suitability of its use as fuel for stationary boilers, locomotives, steamships, and metallurgical furnaces, and recommends its adoption to conserve coal resources, and to release for military use the fuel oil now burned for industrial purposes. Following a description of the indispensable part that electric power plays in the preparation, handling, and burning of pulverised fuel, the second section of the article presents an impressive list of the American users of pulverised fuel. The firms mentioned in this list all use American-made equipment.

Foreign Trade.—The April Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	April, 1918.	*Inc. or dec.*	4 *months*, 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	64,645	− 41,532	− 207.147
Machinery	754,157	+156,616	+ 907,279
Exports.			
Electrical goods ...	145,244	− 75,161	− 618,020
Machinery	1,308,096	+ 28.331	− 1,914.420

Appointments Vacant.—Station superintendent (£226), for the Rawtenstall Corporation Electricity Department; charge engineer (67s. 6d.), for the Bedford Corporation Electricity Undertaking; two switchboard attendants (58s. 6d.) for the Burnley Corporation Electricity Supply Works; shift engineer (50s.) for the Watford U.D.C. Electricity Department. See our advertisement pages to-day.

Standardisation.—A reader on active service in France, writing to thank us for forwarding copies of the Review, says:—

"I recently received the enclosed verses on standardisation from an engineering friend in Birmingham, to whose battery I used to reply with shot from the Electrical Review locker. I at once thought of you, and obtained permission to pass it on to you. I know you will appreciate it":—

STANDARDISATION.

Time was when a man, with head and with hand,
Wrought at his trade. Be it breastplate or brand,
Be it crocket or dripstone or saint in his niche,
He put in his best, be it rivet or stitch.
He chose his own iron, he struck his own blow,
He blew his own bellows, and saw his job grow,
And he finished it off with a sigh of content,
For he knew it was good for he knew what he meant.

But now we must all of us do as we're told,
Nor think for ourselves as we used to of old;
'Gainst freedom of growth we've egregiously sinned,
Our outlook is narrow, our knowledge is "tinned."
We've standardised habits and standardised meat,
We've standardised corns on standardised feet;
Each specialised woman and circumscribed man
Has a crystallised brain in a narrow brain-pan!

For the wisdom of genius and the science of sages
Have given us jigs and have given us gauges,
And to make intellectual efforts the fewer,
They've since introduced the professional viewer.
In short, all our means are directed to quench
The heavenly spark by anvil and bench;
Thank goodness, however, we cannot quite dim it,
We've still a few brains that will not pass the "limit"!

April, 1918. A. Y.

A Royal Visit.—On Tuesday the King and Queen, accompanied by Princess Mary, visited various factories in Essex, including a telephone factory, of which Sir John Bethell is chairman of the directors. The Royal party was received with banners bearing messages of welcome and pledges to work loyally till victory is won, and a large number of girls belonging to the night shift lined the way to the workshops; a considerable number of discharged soldiers who are working in the factory were also drawn up, and the King chatted with many of them before entering the works. The processes of turning metal parts, nickel and tin-plating, spray painting, oxy-acetylene welding, and telephone manufacture were in full swing, and the King inspected an exhibit of field telephones and water-tight telephones for use in mines, the purposes of which were explained by the managing director.

The I.E.E. Wiring Rules.—The Council has adopted a recommendation of the Wiring Rules Committee that Rules No. 68 and 69 in the 7th edition of the Wiring Rules (issued March, 1916) be cancelled and that the following be substituted:—

New Rule 68*X*.—Unarmoured conductors having a sheathing containing not less than 95 per cent. pure lead (the remainder consisting of rarer metals) and of a thickness not less than that specified in the Engineering Standards Committee's Report (No. 7) on "British Standard Copper Conductors" may be used provided that—

(*a*) They are supported by means of clips, saddles, or clamps of such form as will not indent or damage the sheathing and, if metallic, of some metal other than copper. The supports shall be at intervals sufficiently short to prevent appreciable sagging of the conductor.

Conductors when vertical shall be fixed by the same means, with supports at the same intervals, as when horizontal, unless they be inaccessible, when a length not exceeding 10 ft. may be allowed between the supports provided that the upper support firmly grips the cable or wire, and that where there is a change of direction from horizontal to vertical they are brought over a rounded support of a radius not less than three times the external diameter of the sheathing.

(*b*) They are protected by wood or metal casing or conduit where exposed to mechanical injury, and by metal conduit (Rule 63*a*) where buried in plaster, cement, or brickwork. Such conductors laid between floors and ceilings, between lath and plaster or other hollow partitions, or through partitions and walls, need not be so protected.

(*c*) They do not come into contact with damp brickwork or plaster.

(*d*) The metal sheathing of the conductors is earthed and is made electrically continuous throughout by means of wiped joints, or alternatively, by bonding clamps specially designed for the purpose or forming part of boxes or similar fittings entered by the conductors. The continuity of the sheathing shall comply with Rule 69*X* and the earthing with Rules 34 and 35.

New Rule 69*X*.—The resistance of the metal sheathing between any two points of a completed installation shall not exceed two ohms.

Cheese-Making in a Power House.—Canon Sutton, chairman of the Cumberland County Council, has been instrumental in starting a cheese factory at Bridekirk, Cockermouth, which the Board of Agriculture have equipped with plant capable of dealing with 200 gallons of milk daily. The factory has been established in an electric power house belonging to Colonel Green-Thompson.—*Times*.

Metropolitan Munitions.—According to the *Times*, it has been arranged by mutual agreement that the work hitherto done in the London district by the Metropolitan Munitions Committee shall be transferred to the Ministry of Munitions as from July 1st. A letter has been received by the Committee expressing the Minister's cordial appreciation of the very valuable work that has been done.

Electrical Power Engineers' Association.—A general meeting of the Northern Division of the Association was held on May 16th at Manchester, and, in spite of the summer-like weather, there was a good attendance of members and visitors. In the opening remarks of the chairman (Mr. A. L. Lunn) attention was drawn to the steady growth of the membership of the Division, especially in Scotland, the 400 mark having been passed already. During the meeting the findings of the Arbitrator in the Brighton test case were commented upon, the result being considered highly satisfactory, and fully demonstrative of the need for an Association such as the E.P.E.A.

A discussion took place on the prospective Association outlined by Mr. C. H. Wordingham (President I.E.E.) in his address to the Manchester Section of the I.E.E. on April 23rd. There was a general feeling that such a new Association was not required, as the E.P.E.A. was already carrying out the idea put forward by Mr. Wordingham.

The chairman announced the formation of a Sub-Committee to draw up a syllabus for the winter session, and to make the necessary arrangements for papers, &c.

The names of four delegates to represent the Northern Division at the meeting of the National Executive Council, to be held at Birmingham during Whit week, were submitted to the meeting and approved.

The next general meeting of the Northern Division will be held at the Grosvenor Hotel, Manchester, on Thursday, June 20th.

Protecting Castings Against Rust.—According to the *Zeitschrift des Vereines Deutscher Ingenieure*, M. Stübing, an Austrian engineer, puts forward an electrolytic process by which castings may be quickly coated with a layer of cadmium and copper, or cadmium and zinc, as a protection against rust. The protecting layer has a silvery appearance, and can be used for the protection of both iron and steel. The electrolyte is formed by dissolving in 100 litres of water, 1 kgm. of cadmium hydroxide (in the form of sulphate or nitrate), and 1 kgm. of copper hydroxide (in the form of carbonate, acetate, nitrate, or sulphate), mixed with cyanide of potassium or sodium. The object to be plated is first cleaned with dilute acid and then used as the negative electrode, the positive electrode being a plate of copper or zinc. The pressure used is 4 volts, at a current density of 30 amps. per sq. metre of surface to be plated.—*Génie Civil*.

Trading with the Enemy Committee.—The report of this Committee, which has completed its labours, has been laid on the table of the House of Commons. We hope to refer to the matter in a later issue.

Exhibition of Women's Work.—The Labour Supply Department of the Ministry of Munitions of War is holding an Exhibition of photographs and specimens of women's work on munitions of war and allied industries at the Whitechapel Art Gallery. The Exhibition was opened on Wednesday afternoon. It will be open to the public daily on week-days from 12 noon to 9 p.m., and on Sundays from 1 p.m. to 6 p.m., until Thursday, June 20th. The purpose of the Exhibition is to illustrate the progress that has been made in the introduction of women and other hitherto untrained labour, in order to set free skilled or semi-skilled men for the purpose of up-grading or expanding the available supply. From what we have ourselves seen at previous exhibitions of the kind, we think it highly desirable that firms in the London district should arrange for their staffs, and many of their employés, to attend and inspect the exhibits now on view.

"Safety First" in Industrial Work.—The Lord Mayor will preside at a meeting at the Mansion House, on June 12th, at 4 p.m., to inaugurate an extension of the "Safety First" campaign to industrial work.

Why Brown Transgressed.—When Thomas Brown, a baker, of Fulham Road, was summoned at the West London Police Court for selling bread which had been baked less than 12 hours previously, his solicitor explained that baking was delayed for three hours in consequence of an electric wire fusing. He was fined £20.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual meeting of the Newcastle-upon-Tyne Local Section was held on May 13th, Mr. A H Marshall in the chair. The report of the Committee stated that the total membership had slightly increased from 250 last year to 258. The session had been noteworthy for the fact that three papers by local members had been given before the Institution in London and other centres. A most successful reception and meeting were held on the occasion of the President's visit, and, as the result of a suggestion made by Mr. Wordingham, in the course of his address, representations had been made to the Council by the local Committee with a view to the Local Section taking, in the immediate future, a more active part in research and other matters at present engaging the attention of the Council. This Committee had under consideration at present, in collaboration with other local institutions, the formation of an engineers' club in Newcastle, on somewhat similar lines to that already existing at Manchester. It was hoped that an announcement on the matter would be made at an early date. It was again deemed undesirable to hold a dinner, and many members, instead, gave loyal support to the electrical training of disabled sailors and soldiers at the Cowen Home in Newcastle, the sum of £17 16s. 6d. having been thus contributed. A large number of Local Section members were still engaged in His Majesty's Forces; one of the members, Capt. (Acting Major) G. S. Taylor, was awarded the Military Cross, and several members also had been promoted; unfortunately, they had to record the loss of Capt. C. R. M. Young, who died of wounds received in France. The past-chairman, Mr. H. W. Clothier, had been nominated by the Council for election thereto.

The officers and Committee for the session 1918-19 were as follows:—Chairman, Mr. A. P. Pyne; vice-chairmen, Mr. W. Cross and Mr. J. R. Andrews; past-chairmen, Messrs. A. H. Marshall, H. W. Clothier, and P. V. Hunter. Committee:—Power Supply Undertaking—Messrs. E. Fawssett, J. W. Jackson, R. M. Longman, G. L. Porter. Manufacturers and Contractors—L. H. A. Carr, A. Collins, V. O. I. Davis, J. H. Holmes, A. H. Law. Universities and Technical Colleges—Messrs. F. O. Hunt, W. T. MacCall, Dr. W. M. Thornton. Borough Electrical Engineers—H. S. Ellis. Consulting Engineers—Messrs. R. W. Gregory, W. C. Mountain. Civil Service and Railways—Messrs. F. G. C. Baldwin, C. E. Taylor, and the chairman, Tees-side Section, Mr. H. G. A. Stedman; *ex-officio*, hon. treasurer, Mr. C. Vernier; hon. secretary, Mr. J. R. Andrews; assistant hon. secretary, Mr. J. R. Beard; Tees-side assistant hon. secretary, Mr. P. S. Thompson; hon. auditors, Messrs. C. Turnbull and W. F. T. Pinkney.

Mr. C. Vernier, the hon. treasurer, submitted the annual financial statement, which showed a credit balance of £49, and the reports were adopted.

The chairman referred to the sad loss Sir Charles Parsons had sustained by the death in France of his son, Major Parsons. A vote of sympathy was passed in silence, members standing.

Institution of Gas Engineers.—The annual meeting is to take place on June 4th and 5th, at the Institution of Civil Engineers, Westminster, under the presidency of the Right Hon. Lord Moulton, G.B.E.

The Institution of Electrical Engineers. — Annual Report and Accounts.—The report of the Council for the year 1917-18, to be presented at the annual general meeting on May 30th, states that the membership shows a net increase of 54, being now 6,667; in addition, 55 candidates for Associate Membership have been approved by the Council for admission, subject to their satisfying the examination regulations. The total number of alien enemies whose membership has ceased is 42. A rule has been adopted providing for the admission of shift engineers as Associate Members, after holding full responsibility for two years for the plant and staff in a station where 12 men or more are employed, or for a section of a station having not less than 2,000 kw. of load, besides satisfying the regulations as regards training and education as an electrical engineer. An Employment Register is to be set up to assist members serving in H.M. Forces, or engaged on war work, to find suitable employment when demobilisation takes place. Thirty members have given their lives in the service of their country during the year.

The total number of Committee meetings and conferences held during the year amounted to 112.

The Panels set up by the Council to organise researches in connection with insulating materials have made considerable progress; the British Electrical and Allied Manufacturers' Association is co-operating with the Institution, and the Department of Scientific and Industrial Research has made a grant of £2,050 to the Electrical Research Committee (consisting of three members nominated by the I.E.E. and three by the B.E.A.M.A.), which it appointed in May last year. The research on buried cables is proceeding, and involved an expenditure of £324 in 1917, of which £296 was contributed by electricity supply undertakings; the Research Department has provided £750 towards the cost of a special machine at the National Physical Laboratory for the purpose of the tests. The research on insulating oils cost £467 in 1917, of which the Research Department paid £421.

The number of members serving with the Forces since the outbreak of war is 1,869.

The training of disabled men at the Northampton Polytechnic Institute was taken over by the War Pensions Statutory Committee in June, 1917. Up to the end of March last, 17 courses had been carried out; 285 men had entered the courses, and 245 were placed. The number of applications received from employers was over 450.

The Council is taking an active interest in the proceedings of the Engineering Training Organisation, and is contributing £100 to its expenses for the current year; the I.E.E. is represented on the Organisation by Mr. C. H. Wordingham, who has been elected vice-chairman of the Executive Committee.

The Council has appointed a Committee to prepare a scheme for the formation of an Electrical Cooking and Heating Association.

The capital account of the Benevolent Fund at the end of 1917 stood at £4,642, and the accumulated income at £2,062. Donations and subscriptions to the Fund in 1917 amounted to £194, and 14 grants were made, absorbing £198.

The annual accounts of the Institution show an excess of income over expenditure, after providing £3,000 for mortgage redemption and contingencies, of £2,090, compared with £3,777 in 1916. The mortgages now stand at £31,914. The assets amount to £127,897 and the liabilities to £43,117, leaving a balance to the good of £84,780, an increase of £6,591.

During the year 354 books were issued from the lending library to 191 borrowers, comparing with 516 and 240 in 1916.

Munition Workers' Health.—The Minister of Munitions has appointed a Committee "to advise him upon the general principles to be adopted in carrying out the welfare and health work of the Ministry, and to report to the Minister on all matters connected with the same which may be referred to them by him from time to time." The chairman of the Committee is Mrs. H. J. Tennant. The secretary to the Committee is Mr. R. H. Crooke, 53, Parliament Street, S.W. 1, to whom all communications on the subject should be addressed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. F. Woods, station superintendent, Rawtenstall Corporation, has been appointed resident engineer to the Woking Electric Supply Co.

Mr. A. Baxendale, of Bolton, has been appointed car-shed superintendent of the Rawtenstall Corporation tramways.

The Grimsby Electricity Committee recommends that Mr. A. C. Channon be granted an increase of £50 per annum in his salary.

Stepney B.C. Electricity Committee recommends that, in consideration of the extra work and responsibility which devolved upon Mr. W. Young, the resident electrical engineer, and Mr. A. J. Squire, the deputy commercial manager, consequent upon Mr. Tapper assisting the Coal Controller, the Council do make a payment of £50 to Mr. Young and Mr. Squire respectively out of £535 received from the Treasury on account of Mr. Tapper's services, and standing to the credit of the electricity account.

Last Saturday Mr. H. Baker, confidential clerk to the acting city electrical engineer at Hull, was presented with a gold watch, on the occasion of his leaving to take up an appointment with the Rotherham Electricity Department. Mr. Coverdale, the chief clerk, made the presentation.

General.—Another of the heads of departments at the Massachusetts Institution of Technology has been requisitioned by the U.S. Government, Prof. Dugald C. Jackson, in charge of the Department of Electrical Engineering. Prof. Jackson was virtually approved for a commission by the Chief of Engineers before war was declared. In December last Prof. Jackson took the formal oath, and has now been ordered "over there." His commission is that of major in the Engineer Reserve Corps. During his absence Dr. A. E. Kennelly, A.M., S.D., Professor of Electrical Engineering, will be acting head of the department at the M.I.T.

Mr. W. G. Wickham, H.M. Trade Commissioner in South Africa, is now in this country.

The *Times* states that Sir Gilbert Parker, M.P., having decided not to seek re-election for Gravesend, Mr. Alexander Richardson, the editor of *Engineering*, has been adopted prospective candidate at a meeting of the Conservative and Unionist Executive.

Roll of Honour.—Private J. Rose, West Yorkshire Regiment, who is wounded, was with the Phœnix Dynamo Co., Ltd., Bradford.

Private J. H. Baxter, R.E., who has died of wounds, was a cable jointer at the Halifax Post Office.

Sergeant-Major Stanley Parker, K.O.Y.L.I., missing, was an electrician at the Ackton Hall Colliery.

Private J. Morley, Loyal North Lancs. Regiment, killed, was with Messrs. Chas. Macintosh & Co., Ltd., Manchester.

Corporal C. Anderton, R.E., who is in hospital at Perth, has been awarded the Military Medal for gallantry in the field. He was formerly engaged at the Formby power house of the Lancashire and Yorkshire Railway, and joined the Army as an electrician.

Private J. Rayner, Loyal North Lancashire Regiment, who has died of wounds abroad, was employed at the United Electric Car Works, Preston.

Corporal G. F. Langston, R.E., who has died whilst on service, was formerly employed by Mr. Albert Sudlow, electrical engineer, Manchester.

Corporal E. Leslie, South Lancs. Regiment, who has been killed at the Front by an explosion on a railway, was employed in the Warrington Corporation electricity department.

Private O. G. Billingham, Manchester Regt., who enlisted from the Northampton E.L. works, is reported missing.

The death has occurred from wounds of **Sapper J. Hammond**, formerly on the staff of the electricity department of the Malvern Urban District Council.

Capt. H. E. Turner, mains superintendent under the Hull Corporation electricity department, has been killed in action. Recently he was decorated by the King of the Belgians as a Chevalier of the Ordre de la Couronne. He had also received the Croix de Guerre.

Private Glyn Griffiths, formerly engineer at the Pontypridd electricity works, has been killed in action.

Corporal J. Hamilton, formerly employed in the telephone department of the Newcastle General Post Office, has been awarded the Military Medal for great gallantry and devotion to duty.

Lieut. J. B. Langley, R.A.F., son-in-law of Sir Oliver Lodge, was recently killed while flying in this country, aged 29.

Obituary.—**Mr. Charles S. Garnett**, manager of the Darwen Corporation electricity works, whose death in his 41st year was mentioned last week, was appointed manager of the works in 1901, when only 23 years of age, in succession to Mr. Stanley Clegg, to whom he had previously been assistant. The interment was of a public character, being attended by the Mayor and Corporation. The procession was led by a body of special constables, of which Force the deceased was a member.

The death occurred at St. Bartholomew's Hospital, on May 9th, of **Mr. Wm. Hughes**, traffic superintendent with the South Metropolitan Tramways Co.

Mr. Gilbert Tweedie, accountant of the County of London Electric Supply Co., Ltd., recently died suddenly in his office, at the age of 51 years. An inquest was held. A verdict was returned, in accordance with medical evidence to the effect that hæmorrhage on the brain, following recent and old-standing meningitis, was the cause of death.

REVIEWS.

Theory and Calculations of Electrical Apparatus. By Dr. Charles Proteus Steinmetz. London: Hill Publishing Co. Pp. 480 + xxii. Price 17s. net.

In his preface, Dr. Steinmetz alludes to the great developments which have taken place in the theory of electrical engineering since the first publication of his "Alternating-current Phenomena" 20 years ago. In successive editions this original work, which has long ranked as a classic in the literature of electrical engineering theory, has had to be expanded, until at last it has overflowed the limits of a single volume. Accordingly, "Alternating-current Phenomena" has now been separated into three parts under the respective titles of "Alternating-current Phenomena," "Electric Circuits," and "Electrical Apparatus"—the last-named being the volume before us.

For students of Dr. Steinmetz's earlier works, no further recommendation will be necessary than the bare statement that the present volume is fully typical of its author's previous work in its plain and lucid treatment, its simple vectorial analysis, its copious illustration by characteristic curves of performance, and in its masterly reduction of apparently complicated and involved relationships to simple diagrammatic or algebraic expressions—the whole being expressed in simple and unambiguous terms, often with a certain quaintness of expression which one has grown to associate with the name of Steinmetz.

Possibly one word of explanation should be given in regard to the title of the book, which is not well calculated to give a correct impression of the subject matter of the contents. Speaking broadly, the book deals mainly with such types of alternating-current machinery as have as yet found little or no commercial application, and with the adaptation of commercial types to exceptional conditions of operation. In short, a good deal of the discussion is concerned with what are at present regarded as "freaks," but "freaks" of the kind which may, in times to come, be called upon to meet some new demand of the future which cannot as yet be foreseen. The engineer is often called upon to face new problems, or to solve old problems by new methods made necessary by new industrial conditions. In so far as questions of this kind are concerned with alternating-current motors or converters, probably no more stimulating or suggestive aid could be found by the earnest searcher than this latest volume of Steinmetz. The designer or electrical engineer who is often apt to get somewhat restricted in his outlook and experience by a constant repetition of routine calculation based on certain standardised assumptions, will find it refreshing to read about many types of machines which lie outside the normal standards of his everyday practice, such as multi-speed induction motors, motors with multiple squirrel-cages, hysteresis motors; reaction and inductor machines, unipolar generators, and other devices which might otherwise never occur to him as subjects affording scope for profitable and interesting study, even if not of immediate practical use in his work.

The commutating pole, or interpole, was a device which had been known and discussed in its theoretical aspects for many years before its use was recognised as being of industrial importance. It was only when higher speeds and higher armature reactions became common that this "freak" device was found to be valuable, and ultimately came into general use in nearly all large direct-current machines and synchronous converters, and thus ceased to be a "freak" any longer. Another example of an apparently useless theoretical development, which later became of great industrial importance, is the alternating-current commutator motor. Thus, it is evident that for a progressive engineer, it is dangerous not to be familiar with the characteristics and possibilities of the known, but unused, types of apparatus, since it is impossible to foresee when circumstances may arise which will lead to their extensive introduction.

It must, however, not be thought that this volume includes no discussion of machines which are of industrial importance at the present time. This is far from being the case. The full treatment accorded to the various types of single-phase commutator motors is most illuminating, while such subjects as the design of induction motors for special speed characteristics, rectifiers, regulating pole converters, &c., would prove of very real value to the engineer who is called upon to deal with such matters.

In the first chapter, the speed control of induction motors is considered. The problem of securing a high torque over a wide range of speed leads to the successive discussion of a temperature starting device, comprising a rotor winding of high temperature coefficient, a hysteresis starting device, and an eddy-current starting device. Constant speed operation is dealt with in connection with pyro-electric conductors employed for the rotor winding, the use of a condenser in the secondary circuit, and the construction of a "multi-speed" motor with variable number of poles.

The second chapter is devoted to the theory of induction motors provided with multiple squirrel cages, *i.e.*, with two or more separate rotor windings having respectively high and low resistances. The torque of the motor is the sum of the torques due to the several rotor windings; thus the high-resistance winding is responsible for the greater part of the torque at low speeds, and the winding of low resistance is the more effective at speeds near synchronism. We notice in this connection that no reference is made to the proposal to allow a special high-resistance squirrel cage to run free in the air-gap, instead of embedding it with the other winding in the slots of the rotor—a device which has been suggested for reducing the starting current with heavy loads, and is especially applicable to single-phase induction motors.

In the next chapter the cascade, or tandem, connection of induction motors is treated of, while this is followed by a chapter dealing with devices by which the rotor of the motor receives the excitation, instead of the stator. These devices include a motor concatenated with a synchronous alternating-current machine, and with a commutating machine (as in the Lacour motor converter), and finally the Heyland type of compensated motor.

Then follows a chapter on the single-phase induction motor, with the consideration of the numerous alternative starting devices. Further chapters deal with the regulation and stability of induction motors, higher harmonics in induction motors (an interesting analysis of the harmonics due to various spacings of the winding, and the torque due to them), synchronising induction motors, and the synchronous induction motor.

A chapter on the hysteresis motor suggests certain interesting problems which arise when iron is subjected to the influence of a rotary magnetic field.

The frequency converter, or "general alternating-current transformer" forms the subject of an interesting and characteristic chapter in which the stator and rotor circuits of the induction motor are treated from a general point of view as the primary and secondary of a power transformer, in which the transformed power appears partly in mechanical and partly in electrical form. The motor converter supplies an apt illustration of the value of this aspect.

Synchronous induction generators, in which the excitation is supplied to the secondary at a constant low frequency, are the next type of machine to receive consideration, and there follows next a chapter on phase-conversion, which, of course, includes the well-known induction regulator and balancer. Synchronous rectifiers are fully discussed, but electrolytic or arc rectifiers are not included.

Next, we have chapters on reaction machines (*i.e.*, machines which operate in virtue of variations in the reaction flux produced in different positions of the rotating element), inductor machines, and, later on, unipolar machines.

The chapter on single-phase commutator motors has been alluded to already, and forms a clear and masterly survey of this class of machines. Perhaps no type of electrical problem lends itself so well to a general treatment by Steinmetz's methods of analysis, and presents more difficulties to other methods of approach. Whether this is true or not, this chapter is well worth the most careful study, if a clear general view of the characteristics of the various forms of alternating current commutator motor is sought.

Finally, the chapter on the regulating pole converter contains many interesting points connected with the design and characteristics of the rotary converter, and is valuable from a more general point of view than its title suggests.

Perhaps the reviewer may conclude with a statement of fact and a word of advice. Some electrical engineers read Steinmetz, whereas some don't. If you do, you should certainly get hold of this volume and study it; if you don't, you should begin to do so, but preferably with one of the earlier volumes of this valuable series.

Theory and Operation of Direct-Current Machinery. By C. M. Jansky, B.S., B.A. London: Hill Publishing Co., Ltd. Pp. 285 + x, 214 figs. Price 10s. 6d. net.

This book deals solely with the construction and operation of direct-current machines, and with the subsidiary appliances connected therewith, and is intended for the use of men who have little knowledge of mathematics. The matter is divided into 16 chapters, each being provided with a useful summary recapitulating the main points. Five chapters are devoted to main principles, including studies of magnetism, units, laws governing the flow of currents in electrical circuits, and the transformation of energy, in each case little preliminary knowledge being assumed. In dealing with the flow of currents in circuits, more than usual prominence is given to Kirchhoff's laws; this is to be commended, since they are of great use in connection with the study of any problems concerning networks of conductors. The problem of resistances in parallel is not perhaps dealt with in the simplest way, a complicated type of formula being commonly employed. In one problem concerning work English readers may be startled by the fact that a gallon of water is taken as weighing 8.35 lb., and the point certainly adds weight to the agitation for a more uniform system of units.

Some nine chapters are devoted directly to the study of dynamos and motors, and these may be particularly commended from the operating standpoint. Characteristic curves, both of dynamos and motors, are also well explained.

A couple of chapters are set aside for the consideration of systems of distribution, particular attention being paid to three-wire systems. The treatment is generally very clear, but in several places evidence of haste is given, thus the number of dynes in the pound is given as 444,800 on page 43, and as 445,000 on page 62, the latter number being more nearly correct. Again, on page 220, in dealing with the rheostatic control of a series motor, the author states that the only efficient speed is half-speed. We are at a loss to understand this statement, unless the writer has in mind a series parallel control (which is not suggested in the paragraph, and which, as a matter of fact, is dealt with later).

The diagrams, both line and half-tone, are well reproduced, and in the main are of a most suitable kind, though we suggest that a half-tone block of a standard kilogram under two glass jars is not really helpful to the reader of a book of this nature. In fig. 145, showing a diagram of a Tirrill automatic regulator, there is an error in the drawing of the coils of one of the electromagnets. The action of the magnet is correctly indicated in the text, but as drawn it would quite fail to operate. The printing and general arrangement are excellent, and the book is very suitable for men engaged in the operation and construction of direct-current machines, particularly if they are so situated as to be unable to attend any classes, and their need is a book containing the necessary explanations reduced to the simplest form.

NEW COMPANIES REGISTERED.

Cooling Equipment, Ltd. (150,441).—Private company. Registered May 15th. Capital, £1,000 in £1 shares. To acquire an invention relating to fluid cooling devices, and to carry on the business of mechanical and electrical engineers, &c. The subscribers (each with one share) are:—T. H. Wilson, Pinners Hall, E.C. 2, merchant; A. T. Lack, 106, Darwin Street, S.E. 17, clerk. The first directors are to be appointed by the subscribers. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C.

Electro Leather Industries, Ltd. (150,443).—Registered May 15th. Capital, £100,000 in £1 shares. To take over the business of a tanner, hide steriliser, electrical and chemical specialist, and manufacturer carried on by L. A. Groth at Grothine Works, Coulsdon, Surrey, as the Electro Leather Industries. Minimum cash subscription, £70. The first directors are:—L. A. Groth, Grothine Works, Coulsdon, Surrey; A. B. Swales, 9, Scrubbs Lane, N.W.; I. Smith, 42, Heath Crescent, Halifax; G. L. Shepherd, Clare Valley, The Park, Nottingham; A. Jessop, Woodcliff, Rawden, Leeds. Solicitor: J. J. Spence, 13, Park Row, Nottingham.

Crypto Electrical Co., Ltd. (150,466).—Private company. Registered May 17th. Capital, £50,000 in £1 shares (10,000 pref.). To take over the business of electrical engineers, formerly carried on by J. G. Shaw and C. R. Shaw as the Crypto Electrical Co. at Acton Lane, Willesden, and elsewhere. The subscribers (each with one share) are:—J. G. Shaw, Crypto Works, Acton Lane, Willesden, electrical engineer; C. R. Shaw, Crypto Works, Acton Lane, Willesden, electrical engineer. The first directors are:—J. G. Shaw and C. R. Shaw, each of whom may retain office while holding 10,000 shares of either class. Registered office: Crypto Works, Acton Lane, Willesden.

Sentinel Wagon Works, Ltd. (150,470).—Registered May 17th. Capital, £125,000 in £1 shares. To take over as at December 31st, 1917, that portion of the business of Alley & MacLellan, Ltd., engineers and shipbuilders, of Polmadie, Glasgow, which is carried on by them for the manufacture of steam motor wagons at Shrewsbury; also to carry on the business of motor, marine, electrical, and general engineers, iron and brass founders, airship and aeroplane manufacturers, &c. The subscribers (each with one share) are:—S. E. Alley, Sentinel Works, Shrewsbury, engineer; K. M. Alley, Sentinel Works, Shrewsbury, engineer; T. A. Paul, Dunarden, Helensburgh, retired merchant; D. W. McMillan, 143, Bolshagray Avenue, Glasgow, secretary; J. D. Campbell, 95, West George Street, Glasgow, solicitor; K. A. Borland, 95, West George Street, Glasgow, solicitor; A. Brown, 95, West George Street, Glasgow, solicitor. The first directors are:—S. E. Alley, K. M. Alley and T. A. Paul, with power to add four others to their number. S. E. Alley is managing director, and may retain office while holding 20,000 shares. Registered office: Shrewsbury, Salop.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bastian Meter Co., Ltd.—Memorandum of satisfaction in full on September 1st, 1917, of trust deed dated August 21st, 1905, securing £6,000, has been filed.

English Electrical Co., Ltd. (112,639).—Capital, £5,000 in £1 shares. Return dated March 1st, 1918. 526 shares taken up; £526 paid. Mortgages and charges: £10,000.

Cross & Cross, Ltd. (105,754).—Capital, £5,000 in £1 shares. Return dated January 31st, 1918. All shares taken up; £4,845 paid; £155 considered as paid. Mortgages and charges: £600.

Folkestone Electricity Supply Co., Ltd. (51,825).—Capital, £100,000 in £5 shares. Return dated April 26th, 1918. All shares taken up; £100,000 paid. Mortgages and charges: £94,150.

City of London Electric Lighting Co., Ltd. (34,406).—Capital, £1,200,000 in 80,000 ord. and 40,000 pref. shares of £10 each. Return dated April 3rd, 1918. 70,595 ord. and 40,000 pref. shares taken up; £1,105,950 paid. Mortgages and charges: £800,000.

CITY NOTES.

West London and Provincial Electric Supply Co., Ltd.

Mr. H. Kahn presided at the annual meeting on May 15th. He said that they had received £628 more from their holding in the Chiswick Co. owing to their having increased their dividend by 1 per cent. to 6 per cent. for 1917. The management fees received from the Chiswick Co. increased by £575, and the net result was a balance of profit of £3,495. They proposed a dividend on the cumulative preference shares of 6 per cent., less tax, and the interest in arrears for the year 1912 of 4½ per cent. on the funding certificates, leaving £61 to carry forward. The Chiswick Co. (which also supplied at Aberystwyth) showed an increase of £10,360 in sale of current, due in a great measure to the enhanced supply of power for certain works. Cost of generation was £3,290 higher than last year, owing to higher coal, stores, and wages costs. The arrangement with the Hammersmith Council for supply in bulk had worked satisfactorily, and they purchased from the Council current costing £3,924. The Chiswick Co. raised its prices for current in Chiswick by another 10 per cent. at the beginning of the December quarter, making 30 per cent. in all. In Aberystwyth nothing further could be done as the maximum price was already being charged there. It was very difficult to make predictions for 1918 because there was no knowing how much further fuel and oil might go up in price. There was also the 12½ per cent. addition to wages and salaries, the lengthened daylight saving period, &c. Mr. W. B. Esson, the managing director, seconded the adoption of the report.

Austrian Companies.

The accounts of the *Elektrizitats A. G. vorm. Kolben & Co., of Prague*, show net profits and balance forward of £78,000 for 1917, as compared with £72,000 in the preceding year. It has been decided to distribute 10 per cent., this rate contrasting with 9½ per cent. in 1916.

The Ganzsche Elektrizitats A.G., of Buda Pesth, intends to distribute out of net profits of £65,000 a dividend at the rate of 8 per cent. for 1917, as in the preceding year. A year ago it was decided to raise the share capital from £500,000 to £760,000.

The A.G. fur Elektrische Unternchmungen Phœbus, of Buda Pesth, which incurred a loss of £49,000 in 1915, and a lesser loss in 1916, reports insignificant profits for last year, which are carried forward. The company, which has paid no dividend since 1913, now proposes to augment its share capital from £55,000 to £208,000.

The financial statement of the *Felten & Guilleaume A.G., of Buda Pesth*, exhibits net profits of £42,000 for 1917, as compared with £32,000 in the previous 12 months, the sum of £7,000 and £11,000 having been written off for depreciation in the two years respectively. The directors recommend a dividend of 15 per cent., as in 1916, although the share capital participating is larger.

The Carborundum und Elektrit Werke A.G., of Vienna, which also owns works at Dusseldorf (Germany) and at La Bathie (France), reports an increase in the gross profits in 1916-17. After allocating £11,000 to depreciation, as against £4,700 in 1915-16, the accounts show net profits of £27,000, as contrasted with £17,000. The directors recommend the payment of 17 per cent. as compared with 11 per cent., 5 per cent., and 12 per cent. in the three preceding years respectively.

The Felten & Guilleaume A.G., of Vienna, after applying £33,000 to depreciation in 1917, as against £36,000 in 1916, reports net profits of £172,000, as contrasted with £153,000 in the previous year. It is proposed to pay a dividend of 20 per cent., being the same rate as in 1916. The directors state that all departments are well supplied with orders for the current financial year, and full activity would be assured if difficulties did not exist in the matter of procuring coal and other raw materials. The share capital is now to be increased from £354,000 to £416,000 by the issue of new shares at the price of 300 per cent.

Calcutta Electric Supply Corporation, Ltd.—The report for 1917 shows as follows:—Units sold 26,596,827, against 23,575,211 in 1916. Houses connected 9,741, an increase of 280. Gross revenue £259,397, against £237,353. Net revenue £173,949, against £167,370. Exchange 1s. 4d. per rupee. The net profit for 1917, plus the balance brought forward, and interest received, totals £241,070. £39,552 has been placed to the credit of the depreciation and renewal account. Excess profits duty for 1915 and 1916 and an estimated £15,000 for 1917 are provided for, £2,500 is put to reserve, £4,000 to insurance fund, and the total dividend on the ordinary shares is 10 per cent. for the year, leaving £45,964 to be carried forward, after providing for the directors' additional remuneration of £3,000. A pension fund for the staff is to be established, and £7,500 has been placed to the debit of net revenue as a nucleus thereof. Expenditure on capital account last year £23,910. The demand for electrical energy continues to increase.

Potteries Electric Traction Co., Ltd.—Revenue for 1917, £176,745. Traffic and parcel receipts increased by £24,972. Expenses increased by £24,972, although many repairs and practically all renewals have had to be deferred. After paying expenses and debenture interest, and putting £10,000 to renewals, £12,500 is put to reserve, 5 per cent. preference dividend is paid, and 3½ per cent. on the ordinary, carrying forward £8,380. War wages and bonuses were twice increased during the year, and since the close a further increase has been awarded, making the total amount paid in war wages or bonus to male employés 20s. per week, and to female employés 13s. per week over pre-war rates. The right of the Stoke-on-Trent Corporation to purchase the tramways does not arise again until 1924 and 1932. Fares are to be raised to enable suitable reserves to be accumulated, and to meet the increased cost of working.

Electric Construction Co., Ltd.—The net profit for the year ended March 31st, 1918, after providing £6,559 for debenture interest and £10,000 for depreciation, is £66,826, plus £31,442 brought forward, less excess profits duties paid for two years ended March, 1917, £30,240. After paying 7 per cent. on the preference shares for the year, and a final dividend at the rate of 9 per cent. per annum on the ordinary, making 7½ per cent. for the year, and a bonus of 2½ per cent. on the ordinary, all under deduction of income-tax, £9,326 is to be transferred to general reserve, leaving £31,887 to carry forward, subject to liability to excess profits duty. The report states that operations were conducted during the year under abnormal conditions, but, notwithstanding, a large measure of success has been achieved, which is indicated by a substantial increase both in turnover and in net profit. Meeting: May 29th.

Indian Electric Supply & Traction Co., Ltd.—The surplus on working for 1917 in Cawnpore was £17,767, against £20,220 in 1916. Total at credit of net revenue £18,189, and after providing for London expenditure and debenture interest the profit is £12,073, plus £1,757 brought forward. £6,000 is put to reserve for depreciation and renewals, £1,000 to debenture issue expenses, and after paying 7½ per cent. dividend on the shares, and £293 directors' commission on dividends, £685 is carried forward. Mr. W. H. Cheetham has retired from the board, and Sir R. P. Ashton has been appointed in his place.

West India & Panama Telegraph Co., Ltd.—The report shows £113,643 to the credit of revenue. Expenses were £69,343. £6,065 has been deducted as the cost of extending the date of maturity of the debentures; 6s. interim dividend was paid on the first and second preference shares; and 6d. per share (tax free) on the ordinary shares, and after placing £10,000 to general reserve, final dividends of 6s. per share are payable on the preference, and 6d. and a bonus of 3d. per share, both free of tax, on the ordinary shares. The traffic receipts for 1917 increased as compared with those of 1916, but those for 1918 so far show a slight falling off.

Anglo-Portuguese Telephone Co., Ltd.—The gross income for 1917 was £99,506, against £93,578; gross profit, £25,617, against £31,598. After payment of tax, interest, &c., and adding £10,000 to renewals fund, the amount available (including £6,838 brought forward) was £16,092. Further dividend of 3 per cent., less tax, making 6 per cent. for the year; £7,092 forward. The profit was adversely affected by a further fall in the Exchange value of the Portuguese currency. The actual loss on remittances amounted approximately to £22,000, an increase of £6,000.—*Times.*

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—A dividend of 5 per cent. is to be paid on the ordinary shares, £17,000 is to be put to reserve, and £4,580 is to be carried forward. By arrangement with the Government, advances up to £200,000 are to be made to the company to enable it to discharge certain commitments in respect of new plant.

Brisbane Electric Tramways Investment Co., Ltd.—Dividend 4s. per share, free of tax, on the ordinary shares, making 8 per cent. for the year, leaving £36,559 to be carried forward.

Merthyr Electric Traction & Lighting Co., Ltd.—Revenue for 1917 from all sources £28,978, as against £27,179. After meeting expenses and putting £2,000 to renewals, £1,000 to deferred maintenance, paying the preference dividend and 6 per cent. on the ordinary, £668 is to be carried forward. The gross revenue of the electricity supply undertaking increased by £61, and that of the light railways by £1,770.

Kidderminster and District Electric Lighting & Traction Co., Ltd.—In respect of the lighting undertaking, after putting £500 to renewals, £500 to reserve, and paying interest on debentures and preference shares, £45 is to be carried forward. In respect of the tramways, £943 is put to reserve, a dividend of 3½ per cent. is paid, and £190 is carried forward.

Shanghai Electric Construction Co., Ltd.—A dividend of 5 per cent., less tax, is now to be paid on the ordinary shares, making 10 per cent. for the year, and a bonus of 2½ per cent., free of tax. £10,000 is put to reserve for renewals, and £5,000 is written off preliminary expenses.

Metropolitan Carriage, Wagon & Finance Co., Ltd.—Dividends: 5 per cent. for the year on the "A" preference shares, 6 per cent. on the "B" preference shares, 1s. per share for the half-year and a bonus of 1s. per share on the ordinary shares.

Lewes & District Electric Supply Co., Ltd.—Revenue for 1917, £3,649; working expenses, £2,405. After meeting debenture interest, putting £600 to renewals, and £200 to reserve, £688 is to be carried forward.

STOCKS AND SHARES.

Tuesday Evening.

Electrical manufacturing shares are taking up a good deal of attention. Interest has been re-stimulated by the bonus of 2½ per cent. declared, in addition to the 7½ per cent. dividend, by the Electric Construction Co. The price of the shares had been strong in advance, and on the announcement they further rose from 23s. 9d. to 26s., the latter price still including the dividend. The declaration had a strengthening effect upon other similar shares, and the market is good throughout. Edison-Swans hardened to 33s., and the 7 per cent. cumulative participating preference at 21s. 6d. are rather better. Westinghouse preference have rallied ⅛ after their drop, there being some inclination to average on the part of holders who gave more for their shares. General Electrics are strong. Cromptons are better at 16s. for the ordinary, while the preference are close on their par value at £1. The Brush issues are wanted, and the prices in the Stock Exchange Official List might be advanced, because there are buyers about of the ordinary stock at 45, which is the top price quoted in that list. Shares of the cable manufacturing list are also what the Stock Exchange calls a good market, the same difficulty being apparent now as we have noticed upon previous occasions, to wit, that there are not enough shares to supply the would-be purchasers. Henley's have risen 15s. to 20¼.

The manufacturing group is amongst the few in which there is any business worth mentioning on hand at the present time. Other markets round the House are quiet. The strength of the war stocks has a good effect upon other gilt-edged issues, including those of the commercial companies. Men of the new military age are receiving their medical examination notices, and until such men become more definitely settled it is not to be supposed that there will be any particular demand for stocks and shares, except those of the gilt-edged type. The uncertainty runs through the provinces as well as London circles, and the comb-out in so many industries has resulted in a disinclination on the part of the investor to undertake fresh commitments until it becomes clearer what are likely to be the effects of the latest call to the Colours.

Railway stocks are mostly firm, this again applying more particularly to the steam issues. Underground Electric bonds, however, keep a good market at 77, and for the shares of the London Electric and of the Underground Co. also, there has been a quiet pressure to buy that made its effect felt upon prices.

Not a change has occurred in the list of home electricity shares. Dealers said that business has come to something like a full stop for the time being. Nobody expects, of course, to do much in these during the summer months, and the rationing order as applied to electricity introduces a new element of uncertainty as to profits, which will probably keep people out of the market until the turn of the shares for public favour comes round again.

"Tax-free" stocks in the telegraph group have again improved. There are rises this week in Eastern Ordinary, Eastern Extensions, Globe Ordinary, and Westerns. Globe Preference followed the rest, and rose to their par value of £10. Great Northerns are 20s. higher. The telephone shares are also wanted. Chiles at 7¾ are 5s. higher. There is nothing doing in Marconis, but prices hold their ground with a good deal of strength.

British Columbia Electrics are again better, and have risen for three weeks in succession. This time, the 5 per cent. preference stock at 60½ claims the largest advance, being 2 points to the good, but the preferred and the 4½ per cent. debenture have both hardened. Anglo-Argentine 4 per cent. debenture advanced to 70; Manila Electric Fives at 79 are also better. Brazil Tractions hold their price, but the tone has improved in sympathy with the steady rises that have taken place during the last few business days in Brazilian Government bonds. Mexicans are steadily gaining favour, although there are no quotable changes to report in the prices of utilities. Rubber shares remain depressed, in consequence of the reductions that are being made in their dividends by many of the leading companies, and the falling-off in production that has followed the self-denying ordinance of those concerns which agreed to curtail their output by 20 per cent. this year. Armament shares are quiet, and fairly firm. There is less going on in the tin market.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price May 21, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6¾	—	£7 8 0
Charing Cross Ordinary ..	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	5	8	—	8 6 8
City of London	8	8	12	—	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	—	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 18 10
Metropolitan	8	4	3¼	—	6 3 1
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	$2\frac{13}{16}$	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94		6 7 8
do. Def.	33/6	1½	22	— ¼	6 14 10
Chile Telephone	8	8	7¾	+ ¼	5 3 3
Cuba Sub. Ord.	6	7	9½	—	*7 7 4
Eastern Extension	8	8	15¼	+ ¼	*5 5 0
Eastern Tel. Ord.	8	8	154½	+1	*5 3 7
Globe Tel. and T. Ord.	7	7	14½	+ ⅛	*4 15 5
do. Pref. ..	6	6	10	+ ⅛	6 0 0
Great Northern Tel.	22	24	37½	+1	6 8 0
Indo-European	13	13	48½	—	6 14 0
Marconi	10	15	3⅝	—	4 17 10
Oriental Telephone Ord. ..	10	10	4¼	—	2 7 0
United R. Plate Tel.	8	8	7	—	*5 15 4
West India and Pan.	6d.	6d.	1⅛	—	*3 6 8
Western Telegraph	7	8	15½	+ ⅛	*5 8 1

Home Rails.

Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	20¾	—	4 16 5
do. District	Nil	Nil	13¾	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	1¾	+ ¼	Nil
do. do. "A" ..	Nil	Nil	4/6	—	Nil
do. do. Income	6	4	77	—	*5 4 0

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	$2\frac{13}{16}$	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	64	—	7 16 4
Brazil Tractions	4	4	43	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	60½	+2	8 5 4
do. do. Preferred	Nil	Nil	41½	+1	Nil
do. do. Deferred	Nil	Nil	34	—	Nil
do. do. Deb.	4½	4½	64	+1	6 12 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	26½	—	Nil
do. 1st Bonds ..	Nil	Nil	38½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	3⅝	—	4 5 8
British Aluminium Ord. ..	7	10	$1\frac{9}{16}$	+ $\frac{1}{16}$	6 5 0
British Insulated Ord.	17½	20	3⅝	—	5 10 4
British Westinghouse Pref. ..	7½	7½	$2\frac{3}{16}$	+ ⅛	6 17 0
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	$3\frac{13}{32}$	—	5 17 4
Edison Swan, fully paid ..	—	—	2⅝	+ ⅛	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	$1\frac{5}{32}$	+ ⅛	7 12 4
Gen. Elec. Pref.	6	6	10½	—	5 15 8
do. Ord.	10	10	20½	—	4 18 9
Henley	25	25	20½	+ ¾	6 4 0
do. 4½ Pref.	4½	4½	3¼	—	5 12 2
India-Rubber	10	10	15⅝	—	*6 8 0
Telegraph Con.	20	20	42	—	*5 18 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 22nd.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/6	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£75	..
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£43	..
a	Copper Sulphate	"	£67 10/-	..
a	Potash, Chlorate	per lb.	2/6	..
a	" Perchlorate	"	2/-	..
a	Shellac	per cwt.	£17 10/-	£5 dec.
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers ..	"	£35	..
a	" Lump	"	£25	..
a	Soda, Chlorate	per lb.	1/1	..
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c	" Tubes (solid drawn) ..	"	..	..
c	" Wire, basis	"	..	..
c	Copper Tubes (solid drawn) ..	"	1/7 to 1/7½	..
g	" Bars (best selected) ..	per ton	£147	..
g	" Sheet	"	£147	..
g	" Rod	"	£147	..
d	" (Electrolytic) Bars ..	"	£125	..
d	" " Sheets ..	"	£152	..
d	" " Wire Rods	"	£133	..
d	" " H.C. Wire	per lb.	1/4	..
f	Ebonite Rod	"	3/-	1d. dec.
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/3	..
h	Gutta-percha, fine	"	6/10	..
h	India-rubber, Para fine	"	3/3	1d. inc.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£42	..
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e	" " " medium	"	3/6 to 6/-	..
e	" " " large ..	"	7/6 to 14/- & up.	..
d	Silicium Bronze Wire	per lb.	1/8½	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	..	..
n	" Wire, Nos. 1 to 16	per lb.	4/6	..

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

Conservation of Natural Power Resources in Australia.—An article on hydro-electric power development in Australia and New Zealand, published in *Power*, of April 2nd, touches a question which is now of great interest to many. It appears that the Australians have decided to make as wide a use as possible of their natural power resources in the future, and also that they are not willing that these resources shall be exploited by private capital, but shall be developed by the nation in the interest of the nation.

The realisation of the great importance which hydro-electric development will play in the economic life of Australia and New Zealand so far has found expression in the carrying-out of vast schemes of hydro-electric power generation. Of these, the great development contemplated in the North Island of New Zealand deserves special attention. When completed, this enterprise will not only tap most of the best power sources known at present, but will also be interconnected in such a way as to make the resources of each development available for all the other developments.

The whole of the work is carried out by the Government, which will be the owner of the generating stations and of the means of distribution. The cities and large consumers of electrical power will buy from the Government. By this scheme a guarantee is offered that the resources of the country will be developed so as to give the best results.

Australia and New Zealand have been very far-sighted and fortunate in taking early steps to prevent the unhealthy exploitation of their natural power resources. Laws passed years ago made the undertaking of electrical enterprises dependent upon Government licence, and when the time came to tap the great dormant power resources of the country the Government's position was strengthened by additional laws, giving to the nation virtual control of all the existing resources.

Breaking Power Line Insulators.—A boy named Freeman Field, of Stanley, was charged, last week, with damaging an insulator belonging to the Yorkshire Electric Power Co., Ltd., by throwing stones at it. Owing to the breaking of the insulator, the current was interrupted for two hours, and several collieries and a large munition works were seriously affected. The live wire fell into a field. The boy was ordered to pay 15s. 2d. costs, and was placed on probation for two years.

Exports and Imports of Electrical Goods during January, February, and March, 1918.

The official returns of electrical exports and imports for the months of January, February, and March, 1918, which we publish below, show as regards the exports, totals of £225,585, £255,064, and £174,482 respectively, which compared with the three preceding months — October, £345,365; November, £326,684; and December, £288,956—show a falling-off in value in all sections. The electrical imports for the three months under review were :—January, £212,434; February, £163,788; and March, £200,966; these compared with £224,475 in October, £254,644 in November, and £294,883 in December indicate a downward tendency.

The re-exports of foreign and Colonial electrical material fluctuate considerably in value, the figures being :—January, £11,661; February, £9,036; and March, £3,132; as compared with £14,296 in October, £5,206 in November, and £9,541 in December.

Exports and Imports of Electrical Goods and Machinery, January, February, and March, 1918.

	January.			February.			March.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£31,418	£27,491	£5,438	£40,327	£24,640	£1,441	£41,045	£30,690	£955
Insulated wire and cable (not telegraphic or telephonic)	13,088	315	86	13,487	287	1,959	15,500	38	119
Electric glow lamps	8,325	33,797	619	7,129	10,282	2,683	7,544	2,907	238
Arc lamps and parts (not carbons)	2,546	12,149	3,700	4,724	1,028	354	4,568	18,717	100
Meters and instruments	9,359	1,139	42	6.552	446	563	5,819	302	—
Electrical machinery (including switchboards and transformers)	97,625	81,487	1,298	104,336	107,912	535	66,778	134,840	1,113
Batteries	6,389	46.439	161	9,274	14,907	308	5,256	10,529	499
Carbons	445	5,697	77	469	2,026	—	578	1,167	45
Telegraph and telephone wire and apparatus...	56,390	3,920	240	68,766	2,260	1,193	29,394	1,776	63
Totals	£225,585	£212,434	£11,661	£255,064	£163,788	£9,036	£174,482	£200,966	£3,132

NOTES ON WELDING SYSTEMS.

The paper read by Capt. J. Caldwell, M.I.E.E., R.E., before the Institution of Engineers and Shipbuilders in Scotland on January 22nd was discussed at later meetings. An abstract of the paper was given in the Electrical Review of January 25th and February 1st.

Mr. T. T. **Heaton** said that he did not think that any welds should be used, especially where there was any risk to human life, which had not been thoroughly tested. In many cases it was quite easy to test welds, but there were certain things to which no pressure test could be applied. A test which he had used successfully for a number of years consisted of making the weld and hammering it with a hand hammer smartly, with the object of breaking any superficial skin, and then dabbing petroleum on the inside of the weld. Petroleum had a very penetrating power, and if there were a defect in the weld it would show itself in a few seconds. It was not wise to say that any system was the best; it was probably correct to say that each of the systems referred to was the best for some given piece of work. In its place, the system known as the carbon-arc system could not be beaten for efficiency and speed. Considered from the point of view of the metal itself at the weld, no system of welding produced such an excellent result as the resistance method. The resistance method, however, should be looked upon as one suitable chiefly for highly-specialised work, and that was the case more especially in regard to roller welding. He was strongly of opinion that welding would be still more largely used in the future, in the place of riveting or seaming, than it had been in the past. It had been stated frequently that the carbon-arc process hardened the metal at the weld by introducing carbon into it. It could not be too strongly insisted upon that this was not the case, provided that the polarity of the work was properly arranged—that was to say, the work must be the positive pole and the carbon the negative pole. The whole question deserved the careful attention of engineers, because the systems of welding described in the paper were capable of producing joints infinitely superior to those that could be produced either by riveting or any other method. It was not easy to train welders to a state of efficiency without considerable time being occupied in doing so. The most effective method was to train men each for a given job, and to keep them occupied on that job. They then became skilled in the one operation, whereas it was exceedingly rare to find a welder who was capable of undertaking varied work.

Dr. C. H. **Desch** said he wished to make a few remarks, by way of warning, from the metallurgical point of view. They were apt, he was afraid, to incur certain dangers which were not at first apparent to the engineer, but which at once became apparent when metallographic methods were applied. It was so very easy to join two pieces of metal by these processes which were called "welding," but which were really autogenous soldering, that one did not always realise that the metal was permanently changed in the course of the process. In a well-made smith's weld there was practically no difference to be seen, but in making a weld by any process of autogenous soldering the metal was heated to a very high temperature, besides bringing about a change in its chemical composition. He was speaking rather of structural changes brought about by high temperature. He exhibited photomicrographs of electric-arc welds made by one of the processes mentioned by Capt. Caldwell, with the electrode coated with a fluxing material. The mild steel plate used had a normal structure, and it would be seen that there had been re-crystallisation of the steel, giving an overheated structure. The weld as shown in one of the photographs was practically free from carbon, but contained a little oxide. He had an analysis made of the metal, and found that there was a considerable increase in nitrogen in the weld; the amount was not very large absolutely, but it was ten times as great as in the steel plate. Nitrogen had the effect of rendering steel strong with respect to tensile strength, but brittle, and, as a matter of fact, the welds did prove in this particular case to be brittle. They were not burned; they were made by a thoroughly skilled workman, and were apparently good welds, but the metal was hard, and showed a certain amount of brittleness. Some of his photographs also showed the presence of oxide. He did not wish it to be inferred from that that the welding necessarily injured the metal. A great deal depended on the thickness of the metal and the amount of local heating. He did not think that the defects which he had shown would have any effect at all in lowering the tensile strength of the welds, and the piece as a whole would probably not be affected, even in regard to elongation, but he thought that anything in the nature of a fatigue or shock test would show considerable weakening.

Prof. **Malcolm M. Irvine** said there was a notable difference between the acid flux and the basic flux when used in electric welding. The acid flux when in a fused condition had a higher surface tension, and tended to mix with the molten metal. This property was of great significance in connection with vertical welding and overhead welding, such as was frequently met with by boilermakers. The users of acid fluxes adopted what might be called the "broken arc" system. In using this system a rather heavy current was employed, so that during the time the arc was struck the part to be welded, and the welding material, would be completely fused. The flux at that moment—that was, during the period the arc was struck—became molten, and formed a pellicle of slag round the molten tip of the electrode, which was immediately projected on the part to be welded. The welder then hammered this metal immediately it was applied, so as to render it quite homogeneous. The process of striking up the arc, projecting the metal, and hammering was repeated and carried on continuously until the weld was complete. That system was quite different from the "continuous arc" system of welding, such as was embodied in the quasi-arc, the double-arc, and other processes of welding in which neutral or basic slags were employed. In these processes the slags used were mostly basic, and were made so that they would fuse at a certain temperature, considerably below the melting point of iron. The flux must not have too low a melting point, otherwise it left the electrode bare; neither should it have too high a melting point, otherwise the metal would run down and leave a tube of slag which would break the arc. The slag also possessed the property of diffusing over the surface of the molten metal. This was necessary to prevent oxidation. If an abundance of slag were used on a horizontal weld, so that the arc would be completely protected by the slag, then the possibility of oxidation and the combination of nitrogen was greatly prevented. Electric welds, when compared with oxy-acetylene welds, were invariably found superior with respect to tensile strength. Acetylene welds, on the other hand, generally had a higher elongation. The elongation of electric welds was greatly increased by annealing, but this was not always possible, and in circumstances where elongation was particularly desired the welding must be done in a most careful manner. It must be done with the minimum amount of current, and with the shortest and steadiest arc the operator was capable of working with. This naturally pointed to the employment of skilled operators. The operators almost invariably used an excessive amount of current, with the result that the weld was more crystalline, contained a higher percentage of nitrogen, and caused a greater disturbance in the adjacent metal than would be the case if the weld were made under the correct conditions. The work of training welders was rather expensive, and he threw out the suggestion that electric welding should be taught at the Royal Technical College in conjunction with oxy-acetylene welding. At the present time, unfortunately, certain types of welding plant were on the market which were stated to be suitable for either carbon-arc welding or, alternatively, for welding with metal electrodes. It was not possible to do good welding with plant suited for the carbon arc when using metal electrodes. The resistance for carbon-arc welding gave too great a voltage for the arc, with the result that metal electrodes when used on such a resistance deposited the metal in a very granular condition, and frequently in a burned condition. Welds made in that way with a metal electrode gave a tensile strength of 10 or 11 tons, whereas the same metal electrodes used under the proper conditions, and with the proper current, gave a tensile strength of about 32 tons. The remedy, of course, was obvious. Capt. Caldwell, in the course of his paper, opened up an interesting vista of electric welding in its application to shipbuilding. He was not in a position to give a comparison of the costs of electric welding with riveting processes, but he could give the assurance that electric welding in practically every form of shipyard welding was cheaper than welding with the oxy-acetylene process. It was also very much quicker, being in many cases more than twice as quick as the oxy-acetylene process. It was only in the thinner sheet-metal that oxy-acetylene welding compared favourably with electric welding, and, in fact, at the present time for a thickness of 1/16 in., oxy-acetylene welding was really cheaper than electric welding, but above that electric welding was cheaper. He was certain that the cause of that was the price of the electrodes. If the demand for electrodes became considerable, then the price of them would fall very greatly, and under such circumstances electric welding would be incomparably the cheapest and best form of welding for shipyard work.

Dr. J. H. Paterson remarked that his firm had used all types of electric welding processes; they had used electric-welding processes without any flux at all, and he might say that with reasonable care, so far as the quality of the metal was concerned, they found that they could get very nearly as good a metal with the bare electrode as they could get with any kind of flux. He did not say that it was as good a weld, but so far as the metal applied was concerned, he had not been able to prove to his own satisfaction that any one of the fluxes he had come across had been of outstanding merit when compared with the bare metal electrode. The Admiralty and some private firms had conducted many tests, and these tests went to prove that with direct tension a good welded lap-joint was undoubtedly stronger than a riveted joint, but when one came to applying alternating- or bending-stress tests there were no results which proved anything at all. If the construction of the test pieces were analysed it would be found that the stresses were not applied to the metal in the weld at all. This was on account of the fact that the metal in the weld and the metal joined together usually had very different mechanical properties, and the applied test merely demonstrated the approximate efficiency of the least efficient material. He was of opinion that it was time that someone who had no real connection with the financial side of the business should take the matter in hand, and should publish for the benefit of everybody interested at least the outlines of his research, which would place the whole subject on a sound basis. Finally, he might say that electric welding offered almost dazzling prospects, particularly to the shipbuilder. In a report written from one of the Admiralty dockyards, where electric welding processes had been extensively applied, it was claimed that electric welding, if applied instead of riveting, would reduce the cost of labour on the ship by 75 per cent. His want of confidence in welding was due to want of knowledge from a metallurgical point of view—and, moreover, want of knowledge of the type of test to apply in order to get accurate and reliable results. Once they had solved the problem of a weld which would contain no oxygen, they would be in a much better position to estimate the value of electric welding.

Mr. E. H. Jones observed that what he had been endeavouring to do was to find some means of welding steel alloys, so that the metal in the weld should be at least as strong as the metal welded, but he, in common with many other experimenters, had found that it was impossible to weld alloys with an alloy metal so as to make a satisfactory job, as the use of such metals gave rise to porosity, and as the proportions of the rare metals to form the alloy increased, the porosity increased proportionately. Tests which were made with an 80-ton tensile strength alloy formed into welding electrodes showed a strength in the weld made of only *six* tons, due to the cause referred to. He had found that if metals to form an alloy were kept apart until the moment the weld was made, it was comparatively easy to effectively weld any steel alloy. The nickel-coated electrodes referred to by the author of the paper were prepared for the welding of different grades of nickel steel up to 50 tons tensile strength, and particularly for the repair of motor-car crankshafts, driving shafts, axles, and gears, &c., they were proving very successful. He had found that it was of particular importance that the metal added to effect a weld should be superior to that of the work. No matter how the weld was effected there was bound to be a certain deterioration in the metal of the weld, and not only in the weld, but in the metal adjacent to the weld, and if the weld metal was superior to that of the work it would restore and make good the deterioration by diffusion. Experiments he had made with electrodes of high-speed steel showed that the deposition of, or welding with, high-speed steel was impossible, so far as his present knowledge went, but he had found it to be fairly easy to accomplish if the metals to form the alloy were kept apart until the moment of fusion, either with the oxy-acetylene blow-pipe or with the electric arc. He sent to the Institution for inspection by the members some sections of high-speed steel electrodes, or, rather, electrodes to form high-speed steel. They were composed of a channel of mild steel within which the various rare metals to form the alloy were placed, these being powdered and worked into a paste which was run into the channel. To give the carbon content he had found the best way was to add a rod of cast iron, and the carbon in this, diluted by the mild steel and other iron present with the ferro-alloys gave the required proportion. These electrodes were fused on to the work, which, for example, might be a tool shank, by a current of about 200 amperes, and it was easy by this method to obtain a perfectly homogeneous deposit possessing any desired proportion of the rare metals. These electrodes would very shortly be marketed. He would like to take this opportunity of drawing attention to the undoubted merits of alternating current for arc welding. For some reason which he was unable to fathom, the general impression was that continuous current was superior to alternating for arc welding, but, as a matter of fact, he found that alternating current was far superior to continuous, and he would recommend the use of alternating current on every possible occasion. Apart entirely from the capital outlay needed, which was vastly higher in the case of continuous current, the control of the current was much easier to effect. He estimated that the amount of current which would be necessary to feed 20 operators with continuous current would suffice to feed 28 with alternating current.

Mr. O. A. Payne, R.C.N.C., stated that experimental work had been carried out at Portsmouth, and proved beyond doubt that when dealing with plates up to about 20 lb.—(*a*) A widely-spaced single row of rivets connecting two plates with a single run of weld along one edge was stronger than the usual single row of rivets with water-tight spacing. (*b*) A widely-spaced single row of rivets with a single run of weld on one side and an intermittent run of weld on the other was stronger than a double row of rivets with water-tight spacing. (*c*) Where a plate butted on another, *e.g.*, a transverse frame on a continuous longitudinal, a much stronger connection could be made by welding than by the usual angle lugs. (*d*) A thin plate welded between the rows of rivets of a shell buttstrap was effective in enabling complete water-tightness or oil-tightness to be obtained when dealing with leaky butts. (*e*) A plain butt "veed" and welded was quite as strong as, or stronger than, the best riveted joint obtainable, whether riveted by hand, hydraulic, or pneumatic machine in double or treble rows. These and a great number of other experiments had been carried out, including welding vertically, horizontally, and flat—all of which were designed to be carried out to represent the conditions in which such welding would have to be done in actual practice, with the result that they had full confidence in accepting electric welding as a shipyard method of great potentialities; in fact, experience had shown that the development of electric welding was limited only by the difficulty of obtaining an adequate number of trained welders. It was felt that the process only required the trade of electric welders to be organised and properly established when an immense field for this class of work would develop, and shipbuilders would probably be in much the same position as they were now in regard to pneumatic riveting and caulking—that of wondering how they formerly built ships without it.

A FIFTY-THOUSAND SQ. FT. CONDENSER.*

Some of the notable condensers that have been developed and put in service during the last year or two are, for instance, the 50,000 sq. ft. surface condenser of the New York Edison Co., and also one of the Chicago Commonwealth Edison Co., that serves 30,000-kw. generators. Another large condenser, a Leblanc, serves a 45,000-kw. turbine of the Narragansett Electric Light Co., Providence, R.I. It is designed to handle 18,000,000 lb. of circulating water, condensing approximately 500,000 lb. of steam per hour, an equivalent of 36 lb. of circulating water per pound of steam. The largest condenser so far built is one for the Detroit Edison Co., which has 70,000 sq. ft. of cooling surface.

An installation of large surface condensers, of which there will be six, the largest yet built of the Leblanc surface type, is to be located at the bottom of a pit 74 ft. deep. At present there are two 50,000 sq. ft. surface condensers that serve the two 30,000-kw. turbines installed in the present structure of the Windsor power plant of the American Gas & Electric

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* *Power*. Vol. 47, No. 9. Abstract.

Co. Both condensers are of the straight downflow type. Each condenser contains Muntz-metal tubes, of 18 B.W.G., and 18 ft. long. The condensers are 18 ft. inside diameter and 25 ft. long. A portion of the tubes in the upper portion of the condenser, aggregating about 2,400 sq. ft., are used as a primary feed-water heater, through which the condensate is pumped before going to the two open feed-water heaters. The primary heater brings the temperature of the condensate up very near to that of the incoming steam. Each condenser is set below the turbine which it serves. As the turbine must be above the highest point which the river reaches, and the condenser must be low enough to avoid lifting the water at low stages, the 13-ft. diameter exhaust pipe is 40 ft. in length.

Expansion of the pipe and the vertical expansion of the condenser are taken care of by a mercury expansion joint, fig. 1, designed especially for and constituting one of the really novel features of the installation. It is 13 ft. in diameter, and consists mainly of a fairly close-fitting cast-iron sleeve, so formed as to permit a manometric column of mercury to make a seal to prevent air leakage, and at the same time permit of a free motion of the upper and the lower halves of the joints relative to each other. The upper part of the joint is built so that if for any reason the mercury arrangement part of it should fail, an ordinary slip joint with soft packing could be used.

The dotted portion marked "Expansion Joint Clamping Block" is not used with the joint in service. This is simply an arrangement whereby the two portions of the joint can be firmly fastened together for shipment.

It was decided that this type of joint was necessary because the great vertical distance between the condensers and the turbines entailed an extraordinarily great expansion in case the apparatus should be much changed in temperature. The mercury expansion joint can take up an indefinite amount of expansion, whereas there would be a danger that a copper joint, with the great distortions necessary, would ultimately fail.

With each condenser is furnished a horizontal motor-driven circulating pump, having a capacity of 50,000 gallons per minute. There are also two motor-driven Leblanc rotary hydraulic-type air pumps and two motor-driven hotwell pumps. The centrifugal hotwell pumps are driven by 550-volt, 3-phase, 60-cycle squirrel-cage induction motors that are provided with special insulation to withstand the damp atmosphere of the pit.

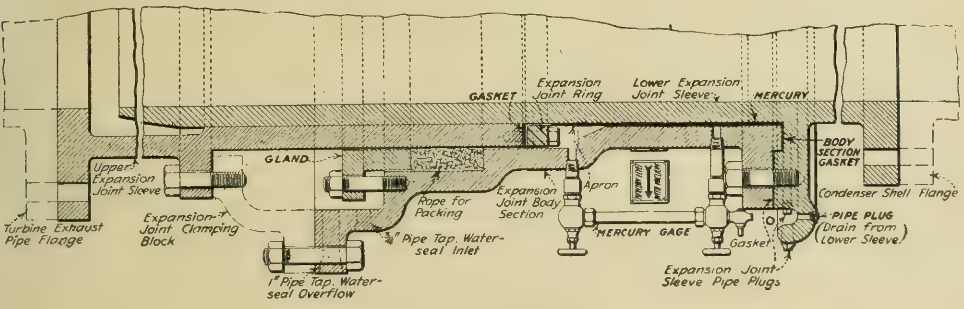
GASKET
Expansion Joint Ring
Lower Expansion Joint Sleeve
MERCURY
BODY SECTION GASKET
GLAND
Upper Expansion Joint Sleeve
Expansion Joint Body Section
Apron
Rope for Packing
Condenser Shell Flange
Turbine Exhaust Pipe Flange
Expansion Joint Clamping Block
MERCURY GAGE
PIPE PLUG
Drain from Lower Sleeve
¾" Pipe Tap. Water-seal Inlet
Gasket
1" Pipe Tap. Water-seal Overflow
Expansion Joint Sleeve Pipe Plugs

Fig. 1.—Section of Mercury Expansion Joint.

At this writing no plant tests have been made on the turbines, but assuming 12 lb. of steam per KW.-hour, each condenser will take care of 360,000 lb. of steam at rating or 7.2 lb. per sq. ft. of cooling surface, and 8.3 gal. of circulating water per pound of steam condensed at rating. Per KW. of generator rating the condenser contains 1.67 sq. ft. of cooling surface.

The opening into the condenser pit is centrally between the steam ends of the two turbines, the foundations of which are formed by the walls of the condenser pit. The Ohio River at Windsor has a rise of 50 ft. from extreme-low to extreme-high water, which necessitated the construction of a condenser pit with the bottom 74 ft. below the turbine-room floor. The basement floor is just about the high-water mark, and the main floor is 18 ft. higher. With the condenser-pit floor 74 ft. below the turbines, it was possible to place the centre line of the circulating pumps at the same elevation with the extreme low level of the river, thus reducing the cost of pumping the circulating water to a minimum.

Steel cross members support the condenser at a height of about 15 ft. above the floor of the condenser pit, which provides space for the circulating, air, and hotwell pumps. The concrete intake and discharge tunnels for the condensing water are built to take care of the proposed ultimate capacity of 200,000 KW. Water coming from the Ohio River through the intake tunnel goes to an intake crib inside the turbine room; the water passes successively through bar-iron grills, travelling screens, and stationary screens to the rear chamber of the crib. The 84-in. diameter cast-iron suction pipe of the circulating pumps drops to this chamber. Water from the condensers discharges from a side outlet on the upper side at one end through a 54-in. cast-iron pipe into a discharge well.

Each circulating pump intake pipe is provided with an extra-heavy sluice gate, operated by a hydraulic cylinder for controlling the flow of water to the pumps. The travelling screens are mounted in a vertical position, and are so arranged that they can be raised or lowered.

The intake and the discharge tunnels from the river to the intake in the station building required approximately 30,000 cu. yd. of excavation, 5,300 cu. yd. of concrete, and 270 tons of reinforcing. The condensing pit, which is 25 ft. 6 in. wide, 91 ft. long inside, and 74 ft. deep, required approximately 32,000 cu. yd. of excavation, 13,500 cu. yd. of concrete placed, and 514 tons of reinforcing steel, as well as 315 tons of structural steel used in the construction.

ELECTRIC SIGNALLING AND CONTROL ON RAILWAYS.

The paper by Mr. C. M. Jacobs, which was abstracted in the Electrical Review of January 18th, was read and discussed before the Manchester Local Section of the Institution of Electrical Engineers on January 15th, 1918.

Mr. J. Sayers said that each signal box, on the main line at least, was really a little power centre or station, which required a supply of electrical energy on quite a large scale as regarded the number of circuits. On the Midland Railway alone, in connection with signal-box circuits, there were roughly 150,000 primary batteries. Automatic signals of the arm type required quite a considerable expenditure of force to make certain that they would operate in all weathers; a battery had to be provided which would supply a very considerable ampere output with a low internal resistance. The number of primary batteries which would operate such signals was very limited indeed. Unless they could put in a continuous power main, the problem of supplying automatic signals was very difficult. He found that a unit of energy from an ordinary Leclanché cell cost about 50s. in pre-war times; it was probably now cheap at £3. On the point of economy alone it was desirable that they should be able to get electric power for doing these things from a central station. In his opinion the development of proper control of signalling was in the direction of making it more automatic, and this development was going to be stopped unless they could get a proper supply of energy along the railway which was not too costly, and which must be absolutely reliable. On the railway between New York and Chicago they had a system of controlling automatic signals, without any trouble, by having a continuous overhead power line along the whole line, and they fed into that any sort of supply they could get. By this method they ensured that if there was a failure of supply at one place they could get a supply from the other direction. The author said that a non-contact method of train control would have been preferred, but so far no such scheme had been considered practicable; but there were some who thought that an inductive method was likely to be practicable. Only those who worked on the railway knew the trouble there was with obstruction, and in no place was obstruction worse than between the running rails. The Great Western system was one of the ramp methods, and, in his opinion, was the best of them all. It had been in use on one of their lines for something like 10 years, and it did exactly what it was put in to do. With an inductive method, it was essential to have a conductor along the whole length of the line, supplied with alternating current at a predetermined frequency. The tuned reed relay of Kramer and Kapp would operate continuously and make a contact with a frequency of 100, breaking at above 105 or below 95. With a system of this kind with such a relay, they had continuous control of the train from the time it started to the time it stopped. One of the limitations of such a system at present was the necessity for power, which had to work 24 hours a day, seven days a week. It seemed that both the old forms of control and those which would probably be used in the future on the railways depended upon a proper supply of power. The opposition of railway companies to the transmission of power near their lines resulted from the difficulty of preventing induction on the telephone circuits. As regarded a power line paralleling a railway, if one could get a company to put up a three-phase line and guarantee that the phases would be equally balanced, and that, if necessary, they would cross the power lines and transpose them, he did not think it would be found that any railway company would put difficulties in the way. With, however, a single-phase line, or a three-phase line which had its phases unbalanced, that would almost certainly cause trouble with the telephone lines.

Mr. P. Lomas referred to the pessimistic view the author seemed to take of his profession. He had in mind something like 300 sections of track circuit, and the failures on the relays connected with these worked out at considerably less than one failure in a million operations. That was hardly just cause for pessimism. It was only fair to electric signal engineers that it should be realised that although failures did occur they were not nearly so frequent as they would be with mechanically-operated devices. The author said a track circuit could not be depended upon to detect anything which did not put virtually a dead short-circuit across the rails. In practice the term "short circuit" was a comparative one. On the London and North-Western Railway no track circuit was allowed to remain in use if it would not operate with 1 ohm joined across the rails, and having once operated it would not restore itself until the value of the short-circuit caused by the train wheels rose to about 5 or 6 ohms. When dealing with railway track-circuits, with timber sleepers and wet cinders for insulation, instead of reckoning insulation resistance in megohms they often had to reckon 2, 3, or 4 ohms as a fair insulation resistance.

Mr. J. D. Paton said that no attempt should be made to establish a system by which the signals were not a part of the locomotive. In the Simmen-Northey system the signals on the ground were cut out. The signals were given in the engine cab. In this country they worked on the principle of making sure about the "danger" and then going ahead; in the States they worked on the "all clear." The man in the Simmen control house had a panel in front of him which represented the entire system of blocks of which he was in control. Every train on that system was moving on that panel, and he actually saw a small needle perforating the position of the trains inside the blocks. In a Court of Law these records were now recognised as superior evidence to oral evidence in a case of accident. This system had reached a point where it had become a great success.

Mr. W. A. Barnes said that alternating-current traction had yet to prove its case in this country; heavy electric traction was almost wholly direct current, and the probabilities were that extensions would be on the same lines, especially where suburban traffic had to be dealt with. The system adopted for electrical signalling should be adapted to the kind of electric traction in use rather than as suggested by the author. On the Manchester-Bury electrified section of the Lancashire and Yorkshire Railway, track signalling with batteries was in use prior to the electrification, but, owing to the voltage drop in the track rails being very variable, and under certain and frequent conditions higher than the voltages used for the track circuits, it was necessary to change over to alternating current for the track circuits. There was an a.c. lighting line running the whole length of the electrified sections, used primarily for the lighting of stations, and power was taken from this through transformers for track circuits. The operation had been quite satisfactory. It would seem essential that electrical signalling should be operated primarily by alternating current.

Mr. A. Davies said that on the Midland Railway the rotary block instrument was an arrangement which combined the block telegraph circuit with the outside signalling installation, and ensured that a signal should not be lowered to permit a train to travel along the line other than that for which the necessary permission had been given.

Ald. W. Walker was under the impression that, from the first, all schemes for the long-distance transmission of electrical energy had been opposed by the railway companies; they had not wanted transmission lines anywhere near their railways. In the discussion the electrical engineers of railways had complained because current was not available at every point on their systems where they now required it for some particular purpose. He rejoiced therefore that at last their assistance might be expected in the development of high-tension transmission, overhead or otherwise.

Mr. C. M. Jacobs, in reply, said with regard to automatic train control, he agreed that it was desirable to keep the railway free from all unnecessary obstruction. He did not think, however, that those who believed in an inductive method of signalling to the train had yet shown them a practical scheme worked out in all its details. From a purely signalling point of view he did not think a continuous indication of the train was necessary. The present semaphore system of signalling gave intermittent indications, and these, if they were properly observed, were found to be sufficient.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,550. "Apparatus for correcting electric impulses." Automatic Electric Co. (Automatic Telephone Manufacturing Co., U.S.A.) & F. C. Tomlins. May 6th.

7,581. "Overload time-limit relays for electric circuits." British Westinghouse Electric & Manufacturing Co. May 6th. (U.S.A., May 7th, 1917.)

7,584. "Electric signal systems." C. E. Lyman. May 6th.

7,596. "High-frequency generators." Marconi's Wireless Telegraph Co. and I. Schoenberg. May 6th.

7,610. "Sparking plugs for internal-combustion engines." H. V. J. Jouffret. May 7th. (France, October 24th, 1917.)

7,616. "Telephone." A. James & A. T. Thompson. May 7th.

7,619. "Electric apparatus for controlling curtains and lights in connection with projecting screen for proscenium of theatres, &c." C. E .Falconbridge & J. W. Leysley. May 7th.

7,629. "Flexible conductors." Western Electric Co. (Western Electric Co., U.S.A.) May 7th.

7,643. "Apparatus for detecting variations in magnetic fields." D. K. Morris. May 7th.

7,649. "Switch for high-voltage circuits." E. G. C. Barton. May 7th.

7,659, "Electric relays." S. G. Brown. May 7th.

7,665/7. "Electrolytic production of zinc." C. H. Clevenger. May 7th. (U.S.A., May 7th, 1917.)

7,668. "Control of magneto-electric generators for effecting ignition in internal-combustion engines." C. H. Grace. May 7th.

7,680. "Maintenance of electric oscillations." T. A. Garrett. May 8th.

7,693. "Electric heating quilts, blankets, &c." H. A. Duxbury & R. O. de K. Hall. May 8th.

7,701. "Electric switches and starters." R. H. Barbour. May 8th.

7,702. "Sparking plugs for internal-combustion engines." H. V. J. Jouffret. May 8th. (France, January 14th.)

7,705. "Manufacture of the metal magnesium and/or alloys of magnesium with other metals by electrolysis." E. A. Ashcroft. May 8th.

7,711. "Telephone systems." Western Electric Co. (Western Electric Co., U.S.A.) May 8th.

7,718. "High-frequency machine with turbine drive." Allgemeine Elektricitats Ges. May 8th. (Germany, January 24th, 1917.)

7,722. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 8th.

7,724. "Machines for slotting commutators, &c." S. E. Aurand. May 8th. (U.S.A., May 11th, 1917.)

7,735. "Starting devices for internal-combustion engines." O. Imray (Bosch Akt. Ges.). May 8th.

7,745. "Prizing devices for electrical machines." Aktiebolaget Ljungstroms Angturbin & Brush Electrical Engineering Co. May 8th.

7,770. "Combined plug, socket and switch fitting for electric circuits." V. Hope. May 9th.

7,775/6. "Means for igniting charge in internal-combustion engines." G. M. Blackstone, E. Carter & F. Carter. May 9th.

7,824. "Electric heating of rivets, studs, bolts, &c." W. Meacher. May 10th.

7,849. "Tubular earths for electric conductors." K. W. Hodges. May 10th.

7,866. "Minimum current cut-out and apparatus for regulating tension and voltage and current from a dynamo." Fabbrica Italiana Automobili Torino & R. B. Ransford. May 10th.

7,877. "Ignition magnetos for internal-combustion engines." J. H. Chambers & H. Lucas. May 10th.

7,881. "Transformer." H. E. Steinbock. May 10th.

7,888. "Electromagnetic devices for use in signalling circuits." J. J. Ghegan. May 10th.

7,905. "Trolley heads for electric traction." J. B. Parker & J. Smith. May 10th.

7,920. "Wireless telephony." L. F. Blandy & R. Whiddington. May 11th.

7,957. "Control of power absorbed in electric furnaces." D. F. Campbell. May 11th.

7,961. "Electromagnetic separator." T. I. Coppin. May 11th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

5,442. Electric Induction Furnaces. C. B. Foley. April 13th, 1916. (114,853.)

13,303. Transmitting Apparatus of Radio-telegraph Stations. F. G. Simpson. September 19th, 1916. (114,854.)

17,988. Dynamo or Magneto Ignition Apparatus. J. G. Zimmerman. May 12th, 1916. (106,466.)

1917.

3,937. Power Traverses in Electrically-driven Lathes, Boring Mills, and other Machine Tools. G. Stirk, E. Stirk, R. Stirk & J. G. Stirk. March 19th, 1917. (114,868.)

4,808. Manufacture of Electric Cables. C. J. Beaver & E. A. Claremont. April 3rd, 1917. (114,872.)

5,224. Telephone Meters. G. I. Bruschke. April 13th, 1917. (114,876.)

5,410. Electric Heating of Metallic Bodies for Forging or other purposes. D. J. Campbell. April 17th, 1917. (114,885.)

5,503. X-ray Apparatus for Surgical and Medical Use. E. E. Greville. April 19th, 1917. (114,893.) (Cognate applications, 8,759/17, 10,652/17, and 12,814/17.)

5,878. Fuses or Cut-outs for Electric Circuits. V. Hope. April 26th. 1917. (114,906.)

6,053. Working of Signals by Electric Currents. W. J. John & J. John. April 30th, 1917. (114,910.)

8,738. X-ray Apparatus. F. J. Harlow. June 18th, 1917. (114,941.)

10,773. Method of Removing and Replacing Electric Storage Battery Connectors. H. S. Bowler & F. Fremmier. July 26th, 1917. (114,948.)

13,028. Electrodes for Ionic Tubes for use more particularly in Wireless Telegraphy. Osram-Robertson Lamp Works & O. Durdle. September 11th, 1917. (114,968.)

13,883. Electrolytic Cells particularly adapted for the Electrolysis of Salt or similar material. N. Statham. September 26th, 1917. (114,974.)

THE

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THE PRESIDENT AND THE PRESS.

THE address which was delivered by the President of the Institution of Electrical Engineers at the annual meeting of the Manchester Local Section contained a number of interesting features; we reproduce it *in extenso* from the *Journal* elsewhere in this issue. In the main it follows on the lines of Mr. Wordingham's inaugural address, in which he outlined a programme of reforms that would tax the energies of an archangel to carry through in the short duration of a single session; it is not to be wondered at, therefore, that, in spite of the pressure of his official duties as Director of Electrical Engineering to the Admiralty, he felt compelled to accept re-nomination for a second year of office as President, although he holds the view which we also have put forward—namely, that the practice which has grown up of retaining the President in office for two years is not in the best interests of the Institution. It is noteworthy that the one-year rule was first broken in favour of Dr. Ferranti for the same reason—to enable him to carry out a programme of progress and reform; unfortunately, the seed then sown fell among thorns, and though it sprang up and bore fruit, it failed to survive the chill blasts of opposition and inertia with which it had to contend. As we then pointed out, while Dr. Ferranti showed the way to the promised land, "great changes must be brought about in social, economic, and legislative conditions before the dream can be accomplished to the full. Intensive agriculture, the redistribution of labour, and the conversion of the local authorities from petty parochial views to recognition of the true interests of the nation, are indispensable accompaniments of the progress called for in technology; and in this ancient country vested interests are certain to be met at every turn, while the Socialistic tendencies of the times, if they go unchecked, may strangle individualism, and therefore progress at its source."* We may fairly claim that practically all of these conditions have been fulfilled, though it never entered our thoughts that the necessary changes would be accomplished by the medium of a world-wide war, which has done in four years what might have taken 40 years of peace. Thus the ground is prepared for a new harvest with vastly more favourable prospects of an ample yield, and we cordially welcome Mr. Wordingham's decision to "carry on" for another year, sincerely hoping that, as he deserves success, so he will command it.

Although the present President was openly opposed to the "Broader Policy" initiated by Dr. Ferranti, and embodied his objections to it in an article in our pages adversely criticising our attitude towards the Council of the Institution,† there are so many respects in which his programme parallels that of 1910 that, after all, we think the divergence is more apparent than real. Most of these points were brought out in Mr. Wordingham's inaugural address;

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* ELECTRICAL REVIEW, November 18th, 1910, page 810.

† *Ibid*, May 29th, 1914, page 896.

others are added in the Manchester address, upon which we may briefly comment.

We are pleased to see that the policy of developing and encouraging the Local Sections of the Institution which has prevailed in recent years is vigorously supported by the President, who says :—" There are not really any Sections or Local Sections of the Institution. There is the Institution, one and undivided." Now, years ago, we cherished the same view, and in that light we reported the proceedings at the Provincial centres thus, for example : " Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester " ; but it came to our knowledge that this style was distasteful to the authorities, and consequently we reverted to the use of the term " Local Section." Nevertheless, we always felt that the practice was, in a measure, derogatory to the dignity and unjust to the importance of some, at least, of the branches of the Institution, whose work was in no way inferior to that of the London members who rejoiced in the title of " The Institution," and we cordially welcome the President's tribute to the merits of the offshoots of the central body, and the foreshadowed change of title.

Another pregnant phrase in the address, which goes far to justify our contentions with regard to the proper functions of the Institution, is the President's declaration that : " *I do not think there is any matter affecting the electrical industry which is not the business of the Institution.*" There is the whole thing in a nutshell. We cannot too strongly emphasise the point, which is precisely that which we have tried to drive home for so many years. We should like to see that sentence in letters of gold adorning the marble halls of the Institution on the Embankment. Further comment is needless—it speaks for itself.

With regard to the formation of an association for central-station staffs—evidently the " Association of British Electrical Engineers (Electricity Supply Branch)," the proposed formation of which was announced and commented on in our issue of April 5th—the scheme outlined by Mr. Wordingham is interesting, and is capable of wide development ; it will be noticed that it is so devised as to link the Association closely to the I.E.E. as the parent body, whilst providing for the admission of non-members of the I.E.E. In the meantime, the Electrical Power Engineers' Association is making rapid progress, and the future relations between these two organisations will provide a very knotty problem for the industry to solve. It would be most unfortunate if they were to exist in rivalry, both covering much the same ground, with the consequent waste of effort and loss of efficiency and influence, and we trust that some *via media* will be found to ensure their co-operation or amalgamation. However, that question will undoubtedly receive attention at the forthcoming meetings mentioned by the President.

Space limitations forbid us to do more than heartily endorse the other proposals contained in the address, some of which, such as the popular and technical lectures, are old friends but have not yet got beyond the proposal stage ; we must, however, add a comment on the concluding paragraph of the report in the *Journal*—namely, that in which Mr. Wordingham, as in his inaugural address, severely deprecates the attitude towards the Institution of " at all events, one section of the electrical Press," while he regards another section as being " to a very large extent lukewarm about the Institution."

The President further remarks that if the Institution happens to do something which a particular section of the Press advocates, then its having done so is practically ignored.

Now, we freely admit that in past years we have felt it incumbent upon us, as sincere well-wishers of the Institution, and with the interests of the industry at heart, to criticise the policy of the Institution Council ruthlessly and persistently, and we adhere to every word that we have written in this vein. But no one who reads our pages could possibly regard us as " lukewarm " towards the Institution ; and whenever the Council has made a step in any direction that we have recommended, we have been scrupulously careful to record the fact and to commend the action. Our record is open to the reader—and we are glad to add that many times in recent years we have had the pleasure of congratulating the Council upon the adoption of new methods and the development of new ideas, in terms which admitted of no misunderstanding, and which were never insincere.

We feel convinced, therefore, that Mr. Wordingham's remarks were not directed against this journal. Yet he suggests that " the Institution cannot get properly treated in the technical Press," a wholesale indictment against which we must emphatically protest. Our conscience is clear, and we confidently appeal to the judgment of our readers.

As for the proposal to develop the *Journal* of the I.E.E., and " create a Press for itself "—well, we agree that the *Journal*, though already greatly improved, offers abundant scope for further improvement ; but the Institution would be well advised to abandon the idea of creating a Press for itself. " If a man bear witness of himself, his witness is vain "—just criticism is exclusively the function of the impartial and independent outsider.

The Enemy in Trade.

IF it were possible to take the anti-German temperature of the British race, we should find it subject to violent fluctuations. It rises several degrees after the enemy has displayed his devilish ingenuity in the form of some new and almost unthinkable atrocity. It is substantially up again since the deliberate bombing of our hospitals in France. If Prussianism paid any regard to the future of German trade relations with its present foes it would, one would suppose, see that every new piece of bombing or submarine barbarism aims a new blow at its own trade, for it settles more definitely than anything else the determination of millions of people in the Allied nations to refuse to re-open commercial relations. But whatever the effect of these horrible outrages upon the Allied mind—and it is an effect to which statesmen will hardly be blind—there are the facts of pre-war days, which have been proved beyond dispute, bearing upon Germany's commercial and industrial penetrative policy. In the course of four years of investigation of such matters, investigations carried out with calmness and dispassionately, unswayed by the fluctuating sentiment to which we have alluded, many practices have been laid bare to legislators and to the trading community which call for a policy of strong determination in the interests of Allied industrial and commercial security. It will be recalled that much criticism was levelled at the head of the Government, because it did not always take immediate action concerning particular interests along the lines advocated by critics. Little by little there was a tightening of the official grip, and one by one enemy concerns were dealt with. The story of what has been done is told in the report of the Committee appointed to advise the Board of Trade on matters arising under the Trading with the Enemy Amendment Act of 1916, of which we give a full abstract on another page, and which we recommend our readers everywhere to study closely. We need not cover the same ground in these comments, but we believe that the electrical industry will agree that if we are going to deal fully with German trade penetration the operations of recently naturalised Germans must not be permitted to escape our attention. We may be better able to tell "who's who " under the Business Names Registration Act, but we ought more jealously to guard against the adoption of the prefix " British " before the name of any concern that decides to open operations here, on however small a scale. In our abstract we quote an example of the methods adopted by Germans to gain control of a certain British electrical concern " by sterilising its power of competition " in our Colonies, and utilising its factory at Home to undercut British manufacturers in the same line of business. The Committee appears to have come up against certain matters which call for investigation, but did not fall within the compass of its operations. We understand that it has completed its labours, but we are sure that so practical and " live " a business man as Sir Albert Stanley will see fit to base a strong preventive policy upon the information that it has accumulated —and perhaps appoint another Committee.

CLINKER DAMS.

By C. M. BENNETT, Wood Lane Works.

The question of suitable clinker dams, or adjustable dumping bars, for mechanical chain-grate stokers is undoubtedly one of great importance, especially at the present time, and has been the subject of careful study from the earliest use of the chain-grate.

Fig. 1 shows a water-cooled dumping-bar which is of interest, as the illustration came to the writer from the late Sir Frederick Bramwell, and was used on the original Jukes chain-grate about 1853.

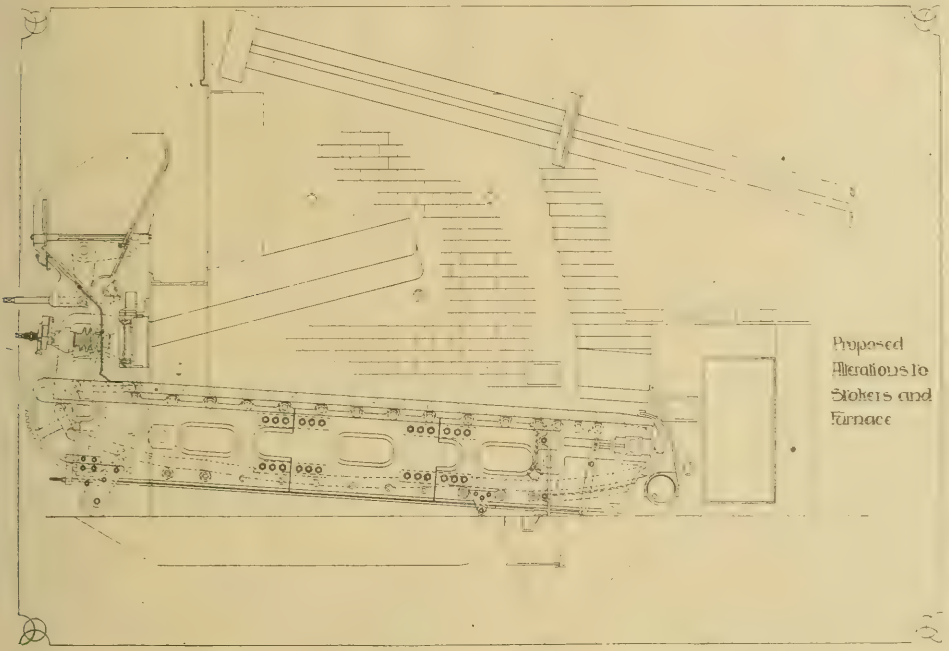


Fig. 2.—Arrangement of Chain-grate Stoker and Dumping Bar.

However, these fixed dumping-bars are, as Mr. G. W. Partridge points out in the article printed in the Electrical Review of April 26th, not suitable for varying qualities of coal, and therefore some adjustable type of bar is essential.

In 1902 a patent was granted to H. W. Miller and C. M. Bennett (see British Patent No. 10,339/02) for an adjustable bar in connection with the close-link stoker, the nose of the bar resting on the surface of the grate, a condition which was not possible on the ordinary type of chain-grate link, owing to the projections formed by the opening of the links in turning over the rear drum of the grate.

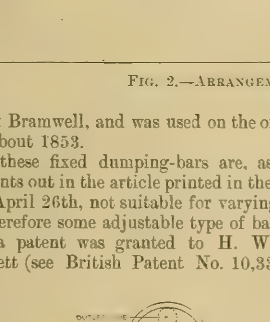


Fig. 1.

The advent of the close-link type of chain-grate described in the British patent above cited, made the problem of the dumping-bar a much easier one, as it became no longer necessary to support the bar off the surface of the grate.

The position of the rear end of the stoker, and, consequently, the position of the dumping-bar in the furnace, is also one requiring consideration and attention.

It is desirable slightly to lengthen the stoker so as to carry the rear drum, together with all the dumping gear, through what may be called the dumping arch, and into a separate chamber formed behind the back wall of the furnace proper.

This arrangement is shown in fig. 2, and it will be seen that the back drum of the stoker and the dumping bar are placed in a chamber which is comparatively cool compared with the furnace; in fact, by opening the inspection door, any dumping bar or clinker trouble can be at once investigated, even when the boiler is under load.

Under these conditions the dumping bars and rear ends of the chain-grate stokers have a much better chance of long performance without renewals than they have when their position is at the front side of the furnace wall.

The "doctor door," or adjustable gate, shown in the article above mentioned, is undoubtedly a great step in the right direction, and all such useful and important devices will come into general use as soon as more attention is given to boiler-house equipment and operation.

It seems, however, that the present arrangement for admitting coal to the furnace by being carried under the furnace doors by the moving chain of the grate is not an ideal one, and could be vastly improved, leaving the furnace doors free for hand-firing in the event of grate breakdown, and allowing for free inspection of the fires through sight holes in the furnace doors, as well as for the admission of air, if necessary, through "hit" and "miss" openings (the air being heated by passing through traps in the door casings). Inspection of fires from the front along the length of the chain-grate is now impossible, because of the "apron-plate" retaining the coal; yet this view of the condition of the bed of burning fuel is a most important one.

The fires of the inner furnaces on many installations cannot be properly seen—in fact, not seen at all, their condition being judged by the outer furnace fires, which can be seen through inspection windows in the side walls.

A BRITISH IDEAL FOR MANUFACTURERS.

By "IMPERIAL."

Some years ago, sitting in the Octagon Lounge of the Midland, at Manchester, were several groups of electrical engineers, one of them discussing the rival claims of Berlin and Hamburg to be considered the centre of German trade. At last, rising to go home, one of the group said: "Why worry with Berlin or Hamburg? *This* is the commercial capital of Germany"—and, looking round at the galaxy of representatives of Siemens, the A.E.G., and many another of the old firms we knew so well, the hyperbole seemed justified. We took our foreign rivals to our hearts, and not only gave them our own orders, but allowed them to regulate our business in other parts of the world.

But this theme, since the war began, has been laboured to death; we cry "Peccavi," and reorganise and reconstruct so that it never can happen again—and all the while with our left hand we do what we swear, with our right extended to Heaven, we abjure for ever. It is true that the parasitic band of irresponsible agents who overran the country factoring German apparatus are inactive — probably munitioneering—and it is true that the German interests are eliminated from the large manufacturers. We may hope that they will never return—we may be sure that in their old form they are dead for a while at least. But when the reconstruction of the world commences, shall we be any more free from futile, unnecessary burdens? Shall we be able to say of our goods:—"This is English, made in England by Englishmen trading with English money"? And if we can say that, shall we be able to command the markets of the world as we command the seven seas?

Perhaps we may; it is one of the rewards we hope to snatch from chaos. But it is all too easy for the reward to be thrown away, and for the same haphazard indeterminate scheme of things to be revived. We most of us know what is wanted, and we each have a different way of getting it. One cries aloud that in the face of Government-subsidised competition we are helpless: let the British Government give grants to every manufacturer; then perhaps we shall get to work as quickly and effectively as a certain giant concern in Huddersfield.

Another calls for protective tariffs, and a third for State control. All this is useless paltering—the mere payment of taxes to receive a part back as our own profits. Besides, did ever a firm admit that the organisation of a Government department was ideal? No; the help that would be obtained would be as useful as when we now complain that aliens crowd us out of our trains. We are told that the accommodation will be limited, that 20 per cent. more will be charged for our season tickets, and then we can fight on the same level as the aliens.

There is no help for it. We must still earn our bread in the sweat of our brows and in the sorrow of our hearts—and we must, above all, work out our own salvation. Everyone knows really what has to be done, and that the root of it is co-operation; co-operation in every direction—between competing firms, between firms and employés, and between employés themselves. Some steps have been taken; we have the B.E.A.M.A. Within that body are conferences on many things—our ratings and our prices are standardised, we each know the others' designs; and in two of the largest firms, the London export manager is the European representative of what used to be the American parent company.

It was with pleasure that we read recently Mr. Annan Bryce's statement that the British Westinghouse Co. had got rid of the American controlling interest, and intended in future to carry out its own research and make its own designs instead of copying the American. But yet the American company will probably, somehow, get to know our standards; the standards not only of the British Westinghouse, but of every manufacturer.

How can we hope to compete if we, with maudlin sentimentality, give our foreign competitors our vital secrets?

We are improving, it is true, on the days when a Meter Conference had a Committee of three—one representing a German, one an American, and one a British firm. What glorious internationalism! But it represents a spirit that still exists. We cannot, apparently, realise that between nation and nation there must be rivalry; friendly or not, it is still rivalry. There is talk of a League of Nations, to guarantee the peace of the world, and the freedom of the seas to all commerce. The only possible living, lasting League of Nations is the British Empire, and that controls the seas and keeps them open to all just, upright, and free men. Let us incorporate that principle in our own affairs; let us have a truly British association open only to firms of pure blood. In the B.E.A.M.A. there are still firms with enemy-born directors. Until recently the British Westinghouse Co. could only say that the majority of its shares were held by British subjects by a verbal quibble; because most of them were held by a limited company registered in England. The shares of this holding company were almost exclusively in American hands.

It seems possible that recent movements tend to increase the predominance of British capital. Amalgamations are afoot which make for powerful British firms, and it is to be hoped they will keep free from undesirable entanglements. It is also to be hoped that they will encourage British engineers in their own works.

Many rumours are afloat of unions of technical engineers—and this new spirit of co-operation is marked by internecine strife between the Society of Chief Commercial Assistants and the Association of Commercial Chief Assistants, or some such bodies. In spite of the strife, it all helps—these bodies may bring pressure to bear on their employers, and, perhaps, that is their only way to success. But is it too much to ask that the new, more or less unfledged directorates should show that they have the interests of the industry at heart, and temper justice to their shareholders with mercy to their staff? The working man has forced himself to be considered; the Whitley Report urges tribunals combining capital and labour—but where, as an egotistical engineer remarked, is the representative of brains? Intelligence has no market value, or we should not find, as we do in one firm, engineers with 10 years' experience, as well as a university training, earning £200 a year, or less, while younger men, with little education, earn on the bench £6, or even £8 a week, making the apparatus that the engineer designs. That any management should see this, and find its sense of equity undisturbed, shows little sign of reformation, particularly as the total paid by many firms to their technical staffs in the way of a war bonus is less than 2½ per cent.

The need is here, and the opportunity is here. Is there no hope for a British movement for the commercial advancement of the country and the individual? The individual recognises that his advancement rests on the success of his company—the commercial future of the country rests on the joint success of its industrial undertakings. Isolated prosperity at the expense of one's immediate neighbours cannot be permanent, and so, since we have during the war at least learned that we are a nation with a national life, let us unite in the national interest. We may, some day, grow old enough to take a wider and international view, but it is first necessary to have a sound basis at home. National unity is the primary essential—unity with one another, and against outsiders. It was once suggested that B.E.A.M.A. stood for British Electrical and Alien Manufacturers' Association, and the stigma was warranted while firms with foreign capital and no works at all belonged to it. There is one ideal it could achieve. It could have an exclusive membership of manufacturing and contracting firms ("contracting" in its widest sense—not merely to indicate wiremen), with a predominance of British capital with purely British directorates who favour British engineers and treat them justly and generously. Such an Association, free from any taint of internationalism, would be an Imperial factor of the first rank. It would command the admiration of this country and the respect of the world.

Roll of Honour.—We have received a pamphlet of 40 pages, containing names and other particulars of the staffs and employés of Messrs. S. Pearson & Son, Ltd., the Mexican Eagle Oil Co., Ltd., and other associated companies, who are serving with H.M. Forces.

LUBRICATION AND ELECTRICAL PLANT.

By G. BASIL BARHAM.

Before the war an electrical engineer could obtain a dozen different varieties of oil to suit each one of his requirements. Were none of these exactly what he wanted, or fancied he wanted, the oil refiner was only too pleased to submit specially blended samples of animal, vegetable, mineral, or composite oils until the test room shelves looked like those of a hospital dispensary, and no one on the staff needed to buy any oil for bicycle, boots, or bitumen-removing for months. The present situation, however, is summed up in the following conversation, reported from a North Country station :—

"Please, sir, the oil's come!"

"Has it, by Jove! Keep about half for the turbine and save a drop for the oil switches; fill the air raid lamps and go up to Dr. Jones' and try and get a Priority Milk Card; if we could get even a quart, we'd try making some margarine!"

Before the war, no electrical engineer would choose an oil solely on account of its lasting properties. They were at that time a secondary consideration; the lubricating qualities were the essential feature, and oil was in itself so cheap that it could be, and was, used in quantities that would seem lavish to-day. It was held that the first essential of a lubricant was that it should possess a low and constant coefficient of friction, so that as little heat as possible would be generated by the moving parts. Although well aware of the fact that were a film of oil maintained between the parts its function would be fulfilled, there were many who apparently tried to float the parts in oil, and it may be asserted that, in view of what can be done at the present time when oil is scarce, in practically every case we had a marked tendency to over-oil.

This was, no doubt, due primarily to the knowledge, gained sometimes from painful experience, that some oils had a tendency to squeeze away and leave parts starved; others contained "filling" which tended to clog and gum, with the result that before long the moving surfaces would start cutting, although they appeared perfectly lubricated. It must be whispered, also, that refiners were vitally interested in the sale of oils; they wanted it known that the oils they supplied would do their work well, and that it was false economy to spare the oil and spoil the crosshead; further, they had really very little to say in favour of oil filters, or the use of cheaper oils, or economy in oil use, or anything else that did not deal with the delivery of so many more barrels per week.

In spite of the lavish use of lubricants, it is a fact that in pre-war days quite 80 per cent. of engine troubles were due to imperfect or improper lubrication. In this, one is not taking into account boiler and air-pump troubles caused through excessive lubrication of the cylinders of vertical condensing engines and piston valves, or through the use of solid soap lubricants containing an excess of caustic soda, which during use is converted into carbonate of soda, a fairly keen cutting material.

At the present time the scarcity of high-grade lubricants necessitates a more lavish use of the human element, and parts and bearings have to be watched that in other days were provided with ample oil and left to themselves. Instead of the many carefully-blended varieties of oil previously available—many of which unkind critics asserted came out of the same vat—the electrical engineer has to be content with plain oil, and he is eyed askance if he shows any disposition to inquire into its constitution and components. A good deal of white lead and also of sulphur is used to-day in stations where such substances were never used, for a similar purpose, before the war, and many an engineer keeps an oil-can ready charged with oil-white lead or oil-sulphur mixture, ready to squirt a quarter of a pint into some part that is showing a disposition to throw off blue smoke, just as his father and grandfather did before him.

Reference has been made to the use of solid and semi-solid lubricants, and where these are perfectly free from the objectionable caustic soda, and are prepared from high-quality materials, they are satisfactory in use. One of their chief advantages is that they will adhere to metal surfaces with tenacity, and if the soap content is not high they can be used on all metals. If there is an undue percentage of soap the oil content is readily squeezed away, and the clogging of the lubricant actually creates friction instead of reducing it. The solid oils are far more economical in use than is generally supposed, and where an engineer can obtain them he should make a fairly large use of such as he knows to be reliable.

As a matter of fact, a great deal of the oil obtainable to-day, unless absolutely fancy prices are paid, is far from reliable, and it will pay the engineer in many cases to break down semi-solid paraffin or vaseline into it, or to add such proportions as he thinks fit of good rape, or castor oil, or tallow, to improve its body and enhance its lubricating qualities.

Contrary to the usual opinion, the frictional resistance of oil is one of its least important properties from a purchaser's point of view. The points of importance are the viscosity of the oil, its cold pouring temperature, and its emulsibility with water. Those which matter comparatively little are the frictional resistance, gravity, and the fire and flash points. The first of these is very much the same with all oils, so from that point of view a dear oil is no better than one which can be obtained at, perhaps, a tithe of the price; and it may be mentioned, also, that high viscosity produces a high degree of friction. This should be borne in mind, by the way, when adding "body" in the shape of some thick, viscid oil to a lubricant of apparently poor quality.

Many electrical engineers are aware that properly refined oils are clear and pale. Even under existing circumstances, when one is almost glad to get any oil at all, "red" oils should be avoided as far as possible, as the element of redness shows that they are not true high-grade oils, and that they contain certain ingredients which have not been properly removed. They are, however, fairly suitable for use where the formation of emulsions does not matter.

Before the war many electrical engineers had a prejudice against mixing good oils of fairly similar qualities. It may be said at once that this does no harm, and only in very rare cases has such mixture resulted in seriously impoverishing or altering any of the properties of the oils. As a matter of fact, the lubricating and physical properties of mixed oils are, for all practical purposes, a mean of those of the constituent lubricants. If, for example, we took a gallon of oil which had 300 seconds viscosity and a flash point of 400° and mixed it with three gallons of oil of 150 seconds viscosity and a 370° flash point, the result would be an oil with a viscosity of 187·5 and a flash point of 377·5°.

The present shortage has brought the subject of filtering and "reviving" oils into prominence. It has been recommended in some quarters that all "old oil," "worn-out oil," "lifeless oil," and so on, should be thrown away and replaced at stated intervals with "fresh" new oil. The use of oil filters was strongly opposed in certain quarters, and from what was said many electrical engineers gained some hazy impression that it was bad practice to use oil over again. There is little or no evidence to show that a good oil wears out or loses any essential lubricating properties under ordinary circumstances. The influence of heat will, of course, drive off a percentage of any original oil, and so cause it to become heavier, but in no way is this detrimental to the oil, which simply has its viscosity raised and its bulk reduced.

The principal trouble with low-grade oils in the past has been that they frequently contain ingredients which in time produce acids or form bad emulsions with water. Any leakage of thin into thicker oils will reduce their viscosity and, to that extent, impoverish them.

Tests which have been carried out on used oils show that the old impression was fallacious, and there would seem to be no reason why electrical engineers should not filter oil over and over again. Good oils used in forced-feed lubrication in internal-combustion engine work—a fairly severe test—for 1,000 hours showed some trace of oxidation; but even then the lubricating properties were neither impaired nor changed to any material extent. There was a slight increase in the formation of resins and of organic acids; and it must be mentioned here that after long use these ingredients might form a percentage sufficient to impair the lubricating properties of the oil if no attention were paid to the matter. Electrical engineers will be interested to hear, however, that not only can these ingredients be removed without difficulty by filtering the oil through animal charcoal, but that it is the practice in the United States Navy to use oil continuously, filtering it periodically, and adding, when necessary, fresh oil to reduce viscosity. It may be mentioned, though the point is not material, that the cold pouring point of the oil referred to above rose to 20° F., from 10° after the 1,000 hours' test.

A few tests of a simple, yet reliable, character, can be made by the electrical engineer which will be of assistance when rejecting unsuitable oils, or when blending some good oil with a percentage of inferior oil in the station, in order to get sufficient bulk to "carry on." These tests are, of course, only crude methods not comparable with tests carried out in a laboratory, but they are in common use amongst trans-Atlantic naval engineers, amongst whom, by the way, it is known to be a fact that any vessel, battleship or destroyer, could, by choosing two oils and blending them herself, lubricate properly everything on board needing lubrication. These tests are as follows:—

Colour.—A good oil, before use, will appear of a pale yellow colour, and will not separate into layers of different shades, or deposit sediment after being allowed to stand for a few days. It will not rust or corrode in any way any pieces of ordinary polished tool steel suspended in it.

Emulsion.—When mixed with warm water and shaken in a bottle the oil will soon separate entirely from the water, and show no soapy emulsion. In regard to this it must be mentioned that the test does not apply to marine engine oil nor to black cylinder stock oils which are blended, for obvious reasons, to produce this very emulsion.

Acidity.—Tests with blue litmus paper will show whether any acid is present. The presence of acid is detrimental to machinery of every kind.

Wax Content.—At ordinary temperatures it is a difficult matter to decide whether wax, either in the form of solid paraffin or some other substance, is or is not present. The readiest test is to cool the oil with ice, when the wax will have a tendency to separate out, and so cause the oil to appear cloudy.

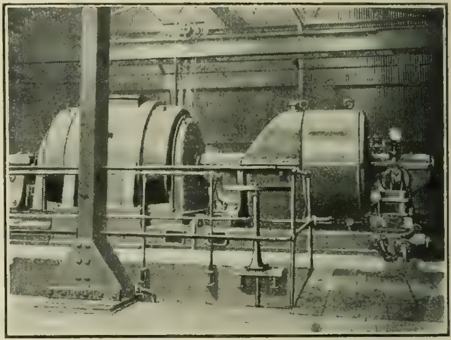
The conclusions arrived at are that for ordinary central station work almost any fair-grade oil will prove suitable for use. Some have high and some low viscosities, the cold-pouring temperature with some is higher than with others; the flash and fire points and the gravities may vary considerably. But so far as ordinary general lubrication is concerned, the difference between any of them is of little importance, and all good oils will prove good lubricants if any objectionable content is removed by filtering. Filtered oil is as good as any other oil; and if one oil is found to be a better lubricant than another, it will generally be found that the results have depended entirely on local conditions. There has been a good deal too much theory and far too little practical test in connection with this matter of lubricating oils, and those electrical engineers who have never felt quite sure of their ground in the matter may take courage from the fact that in more than one instance a warship has managed to get ordinary fuel oil mixed with ordinary machine oil, and has gone on using it as a lubricant for every purpose, and, what is more, has obtained satisfactory results!

A Norwegian Electric Motor Bicycle.—Some trials have lately been held in Christiania with an electric motor bicycle devised and constructed by Mr. Joannes Bjorge, of that city. According to the brief particulars to hand, the battery, which is carried between the two wheels, is capable of running the machine a distance of about 45 miles on one charge. The motor, from which the rear-wheel is driven, is located on the lower part of the frame just behind the battery. The controller and other electrical apparatus are contained in a box carried by the top bar of the frame. It is stated that the weight comes out at about the same as that of a petrol motor bicycle, and that in the trials a maximum speed of 40 miles per hour was attained on the level.

EXTENSIONS AT CHESTERFIELD ELECTRICITY WORKS.

Chesterfield is one of the towns which have had to meet great demands for power since the outbreak of war. The old plant has been considerably overloaded for some time, and consequently the need for the new extension which has just been added was great.

This consists of a new power house containing a Westinghouse-Rateau high-pressure impulse type turbine, coupled to a 2,000-kw. three-phase, 6,600-volt, 50-period alternator with exciter. The condenser is of the Westinghouse-Leblanc multi-jet hung type, with centrifugal water extractor pump and rotary air pump, driven by a 90-h.p. d.c. motor. The air for cooling the alternator is passed through a motor-driven Heenan & Froude wet-air filter.

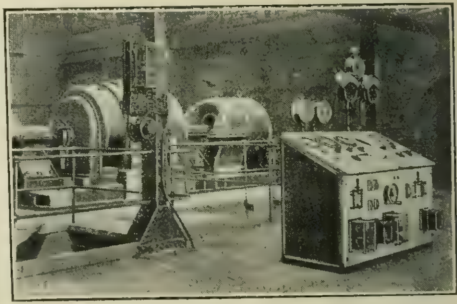


Westinghouse 2,000-kw. Turbo-Generator.

The switchboard gallery contains a switchboard of the desk remote control pattern in white marble; a Westinghouse voltage regulator is also provided.

The discharge water from the condenser is passed over a "Bradford" natural-draught cooling tower capable of dealing with 150,000 gallons per hour. The arrangements allow for considerable extensions. The following were the contractors for the extensions:—British Westinghouse Electrical Manufacturing Co., Davenport Engineering Co. (Bradford), Marsden Bros. (Chesterfield), and C. Ross & Co. (Sheffield).

At the opening ceremony the chairman of the Electricity Committee, Councillor J. E. Clayton, gave a short history of the undertaking, and mentioned that a profit had been made each year since the inception of the undertaking. The vice-chairman. Councillor G. Clark, spoke of the benefit that the extension would prove to the new industries that were being attracted to the town owing to the adequate supply of cheap electric power. The consulting engineer and manager, Mr. R. L. Acland, M.I.E.E., spoke in defence of the linking-up of moderate-sized stations as against the super-station idea. The transmission losses in conveying large amounts of power over long distances, he said, would result in a higher cost per unit sold than would be recorded at a local power station in an industrial area favourably situated as regarded coal and water. He mentioned that Chesterfield had been linked up with a large waste-heat power station for over two years, to their mutual advantage. He acknowledged the services rendered by Mr. Butterfield (who was responsible for the drawings and had acted as clerk of works) and by his chief assistant, Mr. W. A. Toppin.



Remote-Control Switchboard.

The outstanding features of the Chesterfield undertaking are its overhead high-tension transmission, low-tension overhead aluinium conductors, a sub-station giving a steady lighting supply om a traction network, a 500-kw. rotary convertor capable of orking at either 50 or 30 cycles, and the use of coke dust and w-grade fuels in the boiler house. Mr. R. L. Acland has been esponsible for the undertaking from its commencement, and has hown himself to be an enterprising and energetic engineer.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Industrial Combination.

Industrial combination, which is occupying the minds of manufacturers so much at the present time, is by no means a new doctrine, as so many superficial thinkers seem to imagine. The principle is as old as the hills, and the spirit of all past economic history calls loudly to manufacturers to combine and specialise more in their undertakings, in order to increase the world's productivity.

The only difference in the present movement in industry is that the greatest war the world has ever seen has forced on us the necessity to accelerate the progress of industrial combination to a speed hitherto unattained. The old belief in the supreme value of competition being the greatest incentive to cheap manufacture may have been right in days gone by when international competition was not so strong, but whilst admitting the value of healthy competition, we must not become obsessed with the notion and look upon it as a fetish for our belief, otherwise our efforts remain too parochial in character, and we lose that wide vision so necessary for the future of British trade.

There is such a thing as unhealthy competition, and when we view the sorry spectacle of a score or more of firms, each making, among other things, a certain article, and each competing one with another for a portion of a total yearly trade in the product which may not be more than a few thousand pounds in value, how is it possible to argue that it has the tendency to cheapen manufacture? Its effect is just the reverse.

If we are again to attain the proud position our industry once occupied, we have got to adopt any and every means that will stimulate our factories to their greatest productive capacity. Syndication or co-ordination of effort between firms in the same trade will prove to be the greatest of all influences that will bring about the desired end. The operations of individual firms in each industry should be so arranged that the whole combine would act as one body. This would secure the interests of individual manufacturers, and allow them to devote all their energies and all their initiative to that one great necessity—PRODUCTION—instead of having to spend half their time in fighting local competition, and for ever struggling among themselves for a scrappy share of the existing trade in almost every line produced.

One is reminded of the old phrase, "A house divided against itself cannot stand"; and surely this is the position of a great many trades in Great Britain to-day, and most certainly they will never withstand the terrific "offensive" we are to expect from international competition in the future if we do not combine to present a bold and united front to other nations when struggling again for the trade supremacy of the world.

Howard F. Smith.

Birmingham, *May 23rd*, 1918.

A Question of Competition.

I am taking the liberty of bringing to your notice, and if you will permit the hospitality of your valuable columns, that of your readers, to a matter concerning electrical contractors.

During the last 10 years there have sprung into being districts known as Outer London, where Parliamentary powers for the supply of electricity to these districts have been granted to private companies, who not only have the power to supply consumers with the current, but have the right of wiring properties, supplying fittings, heating and cooking apparatus, and everything appertaining to an electrical contractor's business.

This subject, so well known to us where vested in a municipal undertaking, is quite different when given to a private company, and is most unfair competition as between supply authority and contractor. One offending company are all out to cut the throat of the contractors. We have lately experienced some of their methods, and give two instances of the power given to these people.

1. We estimated for an installation at an aircraft factory in competition with them; we secured the contract by £5. Their representative called on our client and made unsatisfactory remarks about us. The work was completed, and they refused to supply a meter without a priority certificate, although no mention of this was in their own specification. We found a suitable meter already on the premises, and our clients were already paying the rent of it, but not using it; we asked for this to be connected to the new mains, which was also refused, and until our client threatened to bring the matter before the Ministry of Munitions, they did nothing, thereby holding up the manufacture of aeroplanes for nearly a week. They then connected up the existing meter, which should, and would, have been done at once, had they carried out the work.

2. We met by appointment at a house, and secured the order for work to be done at once; upon sending, we were informed that the work was going to be done "direct." This is one of many instances where the company claim the right to do all the electrical work there is to do, and actually inform consumers that if they give the work to contractors, they must come to them, so the consumer might just as well come direct.

In conclusion, we are members of the Electrical Contractors' Association, who have had the matter placed before them, and reply that they are aware of the unfair competition carried on by the company, and have taken it up with them more than once. The Association regret, however, that the supply authority being a company, there is no legal means to restrain them from retail trading.

In the meantime, the company continue weekly to advertise in your columns for electricians for "war" and "maintenance" work, more the latter than the former.

Is there nothing that can be done to stop this unfair competition?

Watson, Marsh & Co. (Brondesbury), Ltd.
M. Cohen, *Director*.

London, N.W., *May 16th*, 1918.

Resistance-Temperature Coefficient of Copper.

Referring to the article in the current issue of the Electrical Review, page 486, column 2, there is a misprint in relation to temperature—viz., 10° C. (150° F.), which should be 10° C. (50° F.).

H. Savage.

London, S.E., *May 27th*, 1918.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The President (Mr. C. H. Wordingham) visited the Manchester Local Section on Tuesday, April 23rd, 1918. He was received by Mr. C. J. Beaver, Chairman of the Local Section, and the members of the Committee, and attended the annual general meeting of the section. After the conclusion of the business of the annual meeting, the President addressed the members present, and in the course of his remarks said, *inter alia*:—

I have been nominated by the Council as President for a second year. I should like to explain why I took on the very grave responsibility of accepting that nomination. There are two aspects from which the office of President can be regarded. It may be looked upon as a kind of prize open to every member of the Institution, a prize to be awarded to those whom the Institution, for some reason or another, sees fit to honour. If that be the way in which the presidency is to be regarded then I think clearly no individual is justified in accepting office a second year. The other aspect is that it is the highest possible opportunity of serving the Institution, and that is the point of view from which I have looked at the matter. In my inaugural address I ventured to sketch out a number of directions in which I thought the Institution might, with advantage, be developed, and so far as has lain in me I have done my utmost to follow out the programme I laid down; but a year—or more especially a session—is an extremely short period in which to accomplish anything. A good deal of the work of the session, in the way of papers and so on, is settled in the preceding session, and it is impossible to carry through in one session any large measure of what one hopes is improvement or reform. I felt when the Council did me the honour to invite me to accept renomination, that much of the work I had begun—of course, in saying that I fully recognise that the work is really done by the Council, but one has endeavoured to lend one's hand to the development—would to a large extent be wasted if it were dropped at this point. It was because I hoped, by taking office for a second session, I could see some of this work brought to fruition that I accepted the renomination. But I want to make it quite clear that I do not think a President is justified in taking office a second year on personal grounds.

It is of the utmost importance to the Institution that it should extend its influence in every possible way, and the way in which that influence can best be extended is, first of all, by cultivating and developing what we at present call the Local Sections, and by securing in some way or another the interest of every individual member in the work of those Local Sections and of the Institution as a whole. What appeals to me most strongly is that there are not really any Sections or Local Sections of the Institution. There is the Institution, one and undivided. Some members live in London, some live in the provinces, but it surely must be disastrous to the Institution if advantage can only be taken of the ability of those men who happen to live in London. For that reason I think every possible measure should be taken to enable the Local Sections to develop and to allow the Institution to take advantage of the abilities of those members who happen to live out of London.

We must make the Institution, if it is to be useful, as flexible as possible. We must be on the look-out for important questions affecting the industry, and endeavour to be beforehand in catering for the difficulties which arise. I want particularly to make clear that there are certain matters which the Institution, as an Institution, cannot properly deal with, but I do not think there is any matter affecting the electrical industry which is not the business of the Institution; that is to say, even if we cannot, as an Institution, take action in connection with some matter that arises, it is the business of the Institution to see that proper action is taken, and that, if no body exists which can take that action, such a body is formed.

One matter of extreme importance has arisen during this session. I refer to the need that has become evident for combination among the staffs of central stations. It is quite clear that the Institution as an Institution cannot form an Association, or act as an Association which could look after the interests of the central-station staffs; but the Council, or, rather, I personally, have met a Committee which was formed to found such an Association, and the Council, as a result of that interview, have decided to further in every possible way its formation. The *modus operandi* is that at a very early period there will be called in connection with each Local Section a mass meeting of, not necessarily members of the Institution, but members of the staffs of supply undertakings, to consider the desirability of forming such an Association. Those mass meetings in connection with the Local Sections will be asked to appoint delegates to attend a mass meeting in London, at which I have every confidence this Association will be started. Its object will be to look after the material interests of its members, and it will be proposed that membership of that Association should be based upon membership of the Institution; that is to say, that members of the Association must be corporate members, in one class or another, of the Institution of Electrical Engineers. There will be a further class known as Associate Members, who need not be, and who are not, members of the Institution, but who possess certain qualifications which will be defined. There is another section, the manufacturers' staffs, in regard to whom the Institution has similarly been approached, and I am confident that before long we shall be able to organise a similar Association for the manufacturing staffs.

I want to make it quite clear that these Associations are entirely distinct from the Institution, because the Institution cannot possibly fulfil the requirements that such Associations must fulfil. An Association to be recognised by the Government must have only definite circumscribed aims, and the aims of the Institution are much too catholic and too wide to enable it to act itself as these Associations, but I think by assisting in every way, by countenancing these Associations, by putting the experience of the Institution Council at the service of those forming the Associations in the early stages, the Institution is fulfilling its mission of looking after the industry, and doing it in the most efficient way possible.

I have referred several times to the Local Sections, and I should like to say a little more about them. The Council have set up a special committee to consider in detail how best to extend the activities of the Local Sections. To begin with we hope to call them by a more appropriate name than Local Section. It is to be hoped that powers will be delegated to these Local Sections more especially in regard to carrying out researches in those districts which are peculiarly adapted to the particular research in view. There are districts in the country where facilities exist for production and for testing, which can nowhere else be so satisfactorily found, and the proper way of dealing with these researches seems to be to appoint local sub-committees which will take up and fully develop the matters delegated to them, and report to the main Research Committees in London.

Another very important work that we hope the Local Sections will carry out is that which is already carried out in a large measure in Manchester, viz., the promotion of co-operation among other engineering bodies and branches of engineering bodies. In Birmingham there is a strong feeling in favour of this, and the Council is fostering it in the hope that good results will accrue; similarly in Newcastle, and I have no doubt in all the other centres.

I am keenly interested in the question of proportionate representation on the Council. Under our existing Articles it is impossible to arrange for that, because we have no means of controlling the way in which the election of new candidates is carried out at the ballot, but this year the Council divided up the interests of the Institution into a certain number of heads, and voted for the new nominations separately under each head, so as to secure the desired number of nominations for each interest. The result was that if the Council nominees were in fact elected to the Council, we should have a well-balanced Council, but that scheme breaks down at the ballot because it is not possible to put before the general body of members the same means of subdividing the votes as we adopted on the Council. Further, the Local Sections send their seven Chairmen to the Council, and there is no guarantee that these seven members will not all represent one interest. Of course they never do, but they might. In other words, however careful we may be to maintain the balance among the members of Council elected in the ordinary way, we cannot control in any way the interests which are represented by the Chairmen of the Local Sections.

One word as to the next session. Some things which have advocated it has not been found possible to realise thi year, but I do not see why they should not be next. One thing which I had very much at heart, was an attempt t interest the general public in the work of the Institution by the giving of popular lectures. You are all familiar with the lectures given in London at the Royal Institution abou Christmas time. They have been given for many years past they are a unique affair. I do not think we should have much prospect of success if we attempted to institute lectures of the kind in London, because we should have the competition, so to speak, or, rather, we should be attempting to enter the field so splendidly covered, for many years past by the Royal Institution. So far as I am aware there i nothing of that sort in this district, and I commend most heartily and earnestly to the Local Section the question of organising next year a series of three or four lectures of the kind by some prominent men who have the gift of giving these popular lectures. I believe that if properly organised these lectures would be extremely popular in the city, and it would certainly be a very excellent way of bringing the Institution before the general public.

Another allied matter is the giving of lectures, as distinct from papers, to members of the Institution on specific branches of work. As I said in my inaugural address, many of us would be extremely glad if we could have presented to us, by an expert on the subject, a *résumé* of some newly developed branch of electrical work—for example, electric furnaces. If we could have a full account of all that has been done in that direction brought before the members of the Institution by somebody who was a past-master in the subject, one of the leaders in that particular branch, it would be of great benefit.

I feel very keenly that the Institution has suffered from the publicity which it has experienced at the hands of, at all events, one section of the electrical Press. For some reason which I cannot fathom, nothing which the Institution does can possibly meet with the approbation of a section of the Press, and everything it does meets with their disapprobation. If the Institution happens to do something which that particular section of the Press advocates, then its having done so is practically ignored. I do not understand the reason. Another section of the electrical Press is to a very large extent lukewarm about the Institution, and seldom refers to it. I believe if the Institution cannot get properly treated in the technical Press it will have no choice but to develop greatly its *Journal* and create a Press for itself. A very great deal might be made of the *Journal*. I should like to see it greatly enlarged, and run very much on the lines of a publication whose name I will not pronounce because it is German, but I will simply call it the E.T.Z. All of us must feel the need for some publication in which we could find everything that really mattered for us to know, without having to dig through the enormous amount of verbiage, repetition, &c. Many members, I am afraid, are in the habit of putting away the *Journal* without opening the covers, but if they knew they were going to find a lot of interesting matter which they ought to know in order to keep up to date, I am inclined to think that the covers would not only be opened, but would be very well thumbed. We have made a very humble attempt at rendering the *Journal* more interesting by adding a few pages which are distinct from the general body of the publication, and members who have opened the covers will have found more there than they expected to interest them. I should like to see that developed materially.

(Other matters touched on by the President were:—The British Engineers' Association; Engineers' Clubs; a Royal Charter, and correspondingly enlarged scope, for the Institution; action by the Council concerning Fuel Oil; the Patents Bill; formation of an Electrical Cooking Association; Research; the Electrical Training Organisation; and the National Electrical Proving House.)—From the *Journal* of the I.E.E

TRADING WITH THE ENEMY.

[Report of the Committee.]

In our last issue we briefly referred to the report of the Committee appointed to advise the Board of Trade on matters arising under the Trading with the Enemy Amendment Act. The report is now on sale (Cd. 9059. 1d.) Since their appointment in February, 1916, the Committee have held 139 sittings, at which persons interested were heard, and 960 separate cases have been dealt with. Cases are still being discovered and brought up for their consideration.

The Committee almost immediately were convinced that, in cases in which businesses formerly carried on mainly for the benefit or under the control of enemy subjects were useful and successful businesses, it was more in the national interest to transform them into British businesses than to wind them up, and accordingly, after consulting the Custodian, they have on many occasions recommended that the enemy subject interests should be vested in him as the custodian for sale. In this way a number of useful businesses are now carried on in British hands, which were formerly largely or wholly in the hands of enemy subjects. The Committee, however, only took this course if it appeared probable that a sale would eventuate, and when it seemed doubtful whether the enemy subject interest could be sold or not, they recommended a winding up order in the event of no sale being found possible within a reasonable time. When the business did not appear to the Committee to be of sufficient trade importance to make it expedient to vest in the Custodian, so as to avoid a winding up order, they recommended winding up. Some of these businesses have also passed into British hands by sale in the winding up proceedings. The object of the Committee in recommending vesting useful businesses in the Custodian instead of a winding up order resulting in a sale, was to avoid the discredit which would have attached to the businesses if a winding up order had been gazetted.

In dealing with small retail businesses, which was one of the categories of cases which Sir G. Cave included among those in which it would be inexpedient to order a winding up, the Committee have been guided by the police report and the dossier of the owner of the business. If, in a case of this description, a favourable report was made by the police the Committee did not recommend a winding up unless after examination they had reason to think that a winding up was desirable, and the same course was adopted in cases in which enemy subjects had a son or sons in the fighting forces. In a few cases in which new businesses had been introduced into this country in competition with businesses which were formerly the monopoly of enemy countries, and which depended upon the personal supervision of an enemy subject, the Committee recommended exemption in respect of his individual interest, provided that in other respects they were satisfied that the enemy subject's record showed him to be trustworthy.

It will be seen from Schedule "A" attached to this report that in a number of instances the Committee advised that Section 1 of the Act did not apply. Some of these were cases in which one of the partners, who was an enemy subject, was resident in an enemy country at the outbreak of the war. The High Court has decided in Stevenson's case that under these circumstances the partnership was determined. In such cases the Committee have recommended vesting the interest belonging to the enemy subject in the Custodian, and in other cases in which it was not established that the business was mainly carried on for the benefit or under the control of enemy subjects, and which were, therefore, not cases in which a winding up order could be made, the Committee adopted the same course, and recommended that the enemy subject interest should be vested in the Custodian with a power of sale. In many of the cases, therefore, in which the Committee have advised that they were not within Section 1 of the Act the enemy subject interest has in this way been eliminated.

Cases in which enemy subjects have been resident in this country for a long period of years, have married British wives, are the fathers of children who are British born subjects, and whose record was in other respects unimpeachable, have been strongly pressed upon the Committee as cases in which exemption ought to be granted, but the Committee, in view of the mandatory provision of the Act, have not felt justified in recommending exemption on those grounds only, although they have felt sympathy with some of the persons affected. Enemy subjects, for instance, with those ties, who came to England in the seventies and eighties, have had no connection with their country of origin for many years, but have not been naturalised because it did not occur to them that it was required, and whom it has not been thought necessary to intern, the Committee are inclined to think, are as much entitled to consideration as many of those who have come to England, especially of late years, and have become naturalised.

The Committee have a strong suspicion that in many instances British nationality has been adopted purely as an armour of defence, and it is not at all improbable that the adoption of it has been made a condition of financial support. But such businesses are not within the jurisdiction of the Board of Trade either under Section 1 or Section 4. If, however, German trade penetration is to be fully deal with, some of the cases in which it is carried on by recently naturalised Germans would seem to require consideration.

The business of Ettlinger & Co. is mentioned as a case in point.

An important category of businesses in which the Committee have recommended a large number of exemptions are those of persons who may be described as friendly aliens—Czechs, Ottoman subjects who are members of the fraternity of Spanish and Portuguese Jews, Christian Armenians, and Polish Jews.

As regards Hungarians, the Committee were informed by a solicitor, who represented one of the businesses which was being considered, and who had a professional connection with a number of Hungarian businesses, that British businesses in Hungary were not being interfered with, and that a league existed in Hungary with 3,000,000 members pledged not to buy German goods. It was, however, decided by the Board of Trade not to exempt Hungarian subjects on the ground of nationality alone, but it was rarely found necessary to interfere with Hungarian businesses.

A great variety of cases have been considered by the Committee. They have varied in importance from the Siemens business with a capital employed of over £2,000,000, and the Badische Co., Ltd., with an annual sale of £354,000 of dyes, to that of a tailoring business with a profit of £150 a year. The cases included the following:—Cables and wire, 6; electrical, 41; engineering and building, 36; hardware, &c., 17; machinery, 39; metals, 48.

It was not part of the functions of the Committee to inquire into the genesis of the establishment of the extensive and important trade which has been conducted by enemy subjects, mainly German, in this country, and although such an inquiry would have been interesting, the number of cases which it was the duty of the Committee to deal with precluded any consideration of matters which were not strictly relevant to the issues they had to decide. The sources, for instance, from which the financial support was obtained which enabled such an extensive trade to be established and carried on in this country could not be inquired into.

The cases of the German banks operating in London were not dealt with by the Committee, and the businesses which came before them in which German banks were directly interested were few in number.

The variety of trades in which German subjects were engaged was a noticeable feature of the Committee's work extending from the great chemical and electrical combinations to the collection and export of rabbit skins.

Whatever the business was, organisation, adaptability, personal application, and, in case of necessity, ruthless competition, produced successful results, for in few of the numerous cases upon which the Committee advised was the business found to be unprofitable.

In the course of the Committee's inquiries, the necessity of the legislation for the registration of names has been fully demonstrated. Foreign traders have habitually substituted British names for their own for the purpose of misleading their customers into the belief that they were dealing with British principals instead of aliens.

On one day recently four cases of this kind came before the Committee for consideration, and they had lived under these aliases for years.

The free choice of titles which joint stock companies enjoyed also enable foreign traders to conceal their nationality and acquire whatever advantage may accrue to a business appearing to be a British business.

The practice of adopting the word "British," or some other title or name which disguised the fact that the business was German, is now well known. But the extent to which German businesses were conducted through a British staff and by British employés is remarkable. In case after case the Committee found that, although the profits mainly belonged to the German proprietor of the business, it was carried on entirely or almost entirely by a British staff and by British employés. In many of these cases the British managers and employés are now carrying on the businesses on their own account, and the businesses have become British businesses.

The methods by which German influence gained the control which it had obtained in certain of the trades carried on in this country is well illustrated in the following cases:—

"A company was formed in 1897 to work certain important electrical patents taken out by a British subject whose relatives held the chief part of the capital, the remainder being held by neutrals interested in working the patents in France. The same patents were worked in Germany by a powerful combination. When the patents expired in 1904, practically the whole of the capital of the English company passed into the hands of the German company under the stress of the German company's competition, and a territorial agreement was made, under which the British company was restricted from selling outside Great Britain, even in British colonies. The German company, having obtained control of the British company, and sterilised its power of competition out of Great Britain, proceeded to utilise the manufactory of the British company for the purpose of undercutting a very important business of a similar kind carried on by another British company, until it was forced to accept an agreement under which it had to resign its foreign business, though it still held on to its business in the Colonies.

"Another illustration was that of the manufacture of an article which is extensively made use of by the War Office and the Admiralty. Before the company was formed in 1910 it had been manufactured at works in this country, and contracts with the Admiralty had been held for many years. But the manufacturers had to meet the competition of a powerful German combination, with the result that prices were cut, and in 1910 a representative of the combination threatened to undersell them if a combination was not effected. The manufacturers were not financially strong enough to withstand a competition of that kind, and the result was that the company was formed to take over the business, all the shares in the company being held on behalf of the German combination by British trustees. By the contract of transfer the proprietors of the business were to be employed as managing directors, but one of the covenants provided that they should not manufacture for any other persons than the purchasers. Half the product of the article in question manufactured in England before the war was manufactured at these works. The German proprietors exercised no control over the manufacture which was carried on under the name of the proprietors and managed by them as before. No dividends were paid, but profits were used to improve the works to the extent of £10,000. There was, in fact, no outward and visible sign of the German interest in the business, or that it was not a purely British concern."

The Committee found that German producing houses commonly adopted means to avoid the payment of income-tax in this country. An agency or branch was established here, frequently in the form of a limited company with a small capital, to which goods manufactured in Germany were forwarded for sale at prices which were arranged so as not to allow any considerable margin for profit after the payment of the expenses of the agency or branch, the profit being made by the parent house out of the prices at which they were charged to the branch. This practice, no doubt, is not confined to German houses, but the result has been to assist the competition of German manufactures. These agencies or branches have been usually carried on under British names, and frequently by the employment of British salaried agents.

The important cases in which application was made to the Board of Trade under Section 2 of the Act to determine contracts have been mainly those in which the contracts were with enemy subjects for the delivery of metals or ores, some of them such as that of the Zinc Corporation, of great importance. These cases have disclosed the extent to which Germany had obtained the control of important metal industries.

WAR ITEMS.

Trading with the Enemy.—The "London Gazette" for May 24th contains additions to the list of persons and bodies in Mexico and Uruguay with whom trading is prohibited.

Exports to China.—In the "London Gazette" for May 24th there are some additions to the list of persons and bodies to whom exports to China may be consigned.

Bombs in Switzerland.—It is reported from Geneva that German made bombs have been discovered in Switzerland which were intended for use by Italian anarchists in blowing up certain munition works and electrical installations.

Power Station Bombed.—In the course of a dispatch, dated May 23rd, from Headquarters in France, it was stated that four tons of bombs had been dropped "on the very important electrical power station at Kreusewald (just east of Saarbrücken)." "A boiler house was hit by one bomb, and another bomb caused a large cloud of steam to arise from one of the buildings."

The operation of bombing Kreusewald power station was repeated on the night of 27th-28th inst. Chemical works at Mannheim were also attacked.

Lighting Economy in Barracks.—An Army Council Instruction draws attention to the necessity for the exercise of the most stringent supervision over the use of gas and electric energy in barracks, hutted camps, and other military buildings, with a view to reducing consumption to the lowest possible limits during the present emergency. It is considered that generally in camps, &c., the number and power of lamps might be reduced in many cases, particularly in canteens and other special buildings and establishments, and steps should be taken locally to effect these reductions wherever possible. —*The Times.*

The After-War Appointments Department.—In connection with the setting up of the Training Committee of the Appointments Department recently created by the Government to assist in the resettlement of officers, the Aeronautical Institute of Great Britain, 3, Arlington Street, St. James's, London, S.W., is extending the educational facilities of its workshops with a view immediately to afford a practical educational centre for aeronautical technology and aircraft architecture. The feature of the new arrangements is that all those wishing to avail themselves of the facilities afforded can do so at their own time, either in the day or the evening. The courses, which are under Mr. L. Blin Desbleds, are available also to those already in the aeronautical industry.

Entertaining Wounded Soldiers.—Last Saturday afternoon a number of wounded soldiers from the Cossham, Foye, and Bannerleigh Hospitals were the guests of the ladies of the administrative staff of the Bristol Corporation electricity department at the Exchange, and were taken by horse brakes to Clevedon, a distance of 18 miles from hospital. The weather was ideal. A guest was specially allotted to each lady, and after a most enjoyable drive, tea, prepared by the ladies, was partaken of at Wickenden's Restaurant. Photographs of the party were taken in the copse close by. The party, including a few members of the male staff, numbered about 80, and on the return to Bristol hearty thanks were accorded to the ladies.

Exemption Applications.—At Burnley Tribunal, exemption to August 31st was given to an electrical engineer (37, B 1), who said his work was mainly maintenance work, and if he had to go into the Army the business would close. He pointed out that his workmen had been badged.

At Southwark, the National Service Representative has agreed to six months' exemption being granted, with leave to appeal again, to W. H. Donovan, manager and buyer, 36 years of age, fit for labour at home (C 3), of the London Commercial Electric Stores, Ltd.

At Swindon, a review was made of the case of W. J. Moran (37, C 1), electrician with Messrs. Bays & Co., given conditional exemption two years ago. Mr. E. Bays stated that Moran was the only electrician the firm now had. Two months were substituted.

At Dover, Military appeals against two drivers, one in Class B 1 and the other in B 2, of electrical scavenging vehicles, employed by the Corporation and exempted until July 27th, were dismissed

At Southport, the exemption held by a fitter and repairer for 16 years engaged with the Corporation Tramways Committee, was withdrawn, he having been born on June 30th, 1886. It was intimated that the matter was now left with the Ministry of National Service whether he was called up or not.

The Southport Tribunal has given exemption until August 1st to enable a substitute to be obtained, to an engine driver (31) with the Birkdale Electric Supply Co.

At Southport, on a review, conditional exemption was withdrawn in the case of the electrician at the Prince of Wales Hotel (35, Class A), having charge of the electrical installation, and he was given until August 1st, with the intimation that every effort must be made to replace him.

At Swinton (Lancs.), an appeal was made for the retention of the electrical engineer (39, Class A) at a local works, stated to be responsible for the whole of the power plant and lights. It was considered expedient, despite his class, that he should remain in his employment. Three months v
conceded.

An appeal was made at Burnley for a driver on the
poration tramways (39, C 1), claimed to be in a certified o
pation. Mr. Parker, National Service Representative,
that it was not in the national interest that a man of
category mentioned should be kept out of the Army.
added that it did not take long to train a driver. Mr. Joh
stated that the man had been in the tramway department
11 years, and the Committee wished to keep their old
perienced drivers. The man was exempted until July
when he is to be regraded.

On a review, the Barking Tribunal have cancelled exe
tion held by J. W. Bristow (31, Class A), motorman on
trams, and he is to be called up within a month.

The East Kent Appeal Court heard an appeal by the F
stone Electric Supply Co., Ltd., for A. J. Jenkins (30),
clerk. Mr. T. Hesketh, for the company, said that they
plied the whole of the Military and Government departm
whilst the harbour relied on them for light. Col. Atki
argued that the man was the clerk of an industrial conc
The Court dismissed the appeal.

Before the Dorset Appeal Court, further exemption
sought for T. H. Escott, manager for Brooking & Co.,
trical engineers, of Weymouth. He was ordered to be
graded.

Before the Bucks Appeal Court, in the case of B. Bow
(37, Grade 1), electrician, of Mintmore, it was stated that
Tring Rural Tribunal had reduced his conditional exem
to six months, and the Military appealed. The period
further reduced to three months.

At Calne, exemption was sought for A. H. Mackenzie
Class A), electrician in sole charge of the electric plant a
works of the Bacon Company. He was finally exempted
July 15th.

At Castleford, an appeal was made by C. J. Cox, state
be the only man in the town doing electrical enginee
repairs, and who is responsible for the upkeep of plan
many works in the district. Six months' temporary exem
was conceded.

Before the Herts Appeal Court, M. J. Connare (38, G
2), electrical engineer, of Watford, applying for a medica
examination, claimed that he was in a certified occupatio
virtue of his being a direct contractor for the War O
The Chairman said they could do nothing for him. He
had two chances, one to go to the War Office for prote
if he was doing what he said he was, and the other was
if he was in the list of protected occupations he was all r

At Rotherham, E. W. Mitchell (18, Grade 1), assi
draughtsman in the Corporation electricity works, app
as a conscientious objector, and said that he must a
that, in a sense, he was helping the war, because ele
power was largely used in the manufacture of munit
He offered to give up the work and go farming, but n
replace a man for active service. He was given condit
exemption on obtaining work of national importance thr
the Pelham Committee.

The East Kent Appeal Court has dismissed an appe
A. W. Perry (42, Grade 1), chief clerk to the Isle of T
Tramways & Electric Light Co.

IMPORT TRADE OF CHINA.

The Chinese Imperial Maritime Customs have recently iss
volume giving the countries of origin of the principal im
into China during 1915-16. The following figures, sho
the value of imports in 1915 and 1916 of goods of intere
the electrical engineering industry, have been extracted
this volume, and the increases and decreases are shown.
to be noted that the average value of the Haikwan T
1915 was 2s. 7⅛d., and in 1916 was 3s. 3 13/16d.

	Hk. Tls. 1915.	Hk. Tls. 1916.	Hk Inc. o
Electrical materials and fittings.—			
From Great Britain ...	404,000	711,000	+ 30
,, Hong-Kong ...	260,000	340,000	+
,, Canada	3,000	74,000	+
,, Russia	30,000	20,000	−
,, Italy	20,000	34,000	+
,, Japan	845,000	1,699,000	+ 8
,, United States ...	285,000	614,000	+ 3
,, Other countries ...	238,000	77,000	− 1
Total	2,085,000	3,569,000*	+ 1,4

* Includes 137,000 Hk. Tls. re-exported.

	Hk. Tls. 1915.	Hk. Tls. 1916.	Hk Inc. o
Copper, bars, rods, sheets, plates, wire, and nails.—			
From Great Britain ...	14,000	9,000	−
,, India	3,000	2,000	−
,, Russia	10,000	20,000	+
,, United States ...	4,000	19,000	+
,, Japan	204,000	347,000	+ 1
,, Other countries ...	15,000	19,000	+
Total	250,000	416,000	+ 1

	1915. Hk. Tls.	1916. Hk. Tls.	Inc. or dec.	Hk. Tls.
Railway carriages and wagons, including tramcars.—				
From Great Britain ...	106,000	54,000	–	52,000
,, Belgium	10,000	2,000	–	8,000
,, Russia	13,000	292,000	+	279,000
,, United States ...	172,000	120,000	–	52,000
,, Other countries ...	335,000	201,000	–	134,000
Total	636,000*	669,000†	+	33,000

* Includes 49,000 Hk. Tls. re-exported.
† Includes 133,000 Hk. Tls. re-exported.

	1915. Hk. Tls.	1916. Hk. Tls.	Inc. or dec.	Hk. Tls.
Machinery, propelling (as boilers, turbines, &c.).—				
From Great Britain ...	313,000	322,000	+	9,000
,, Italy	—	84,000	+	84,000
,, Russia	127,000	4,000	–	123,000
,, Japan	76,000	34,000	–	42,000
,, United States ...	127,000	131,000	+	4,000
,, Other countries ...	68,000	31,000	–	37,000
Total	711,000*	606,000†	–	105,000

* Includes 34,000 Hk. Tls. re-exported.
† Includes 30,000 Hk. Tls. re-exported.

	1915. Hk. Tls.	1916. Hk. Tls.	Inc. or dec.	Hk. Tls.
India-rubber and gutta-percha manufactures, including shoes and boots.—				
From Great Britain ...	57,000	43,000	–	14,000
,, United States ...	42,000	63,000	+	21,000
,, France	32,000	34,000	+	2,000
,, Russia	90,000	66,000	–	24,000
,, Japan	287,000	195,000	–	92,000
,, Other countries ...	31,000	20,000	–	11,000
Total	539,000	421,000	–	118,000
Telegraph and telephone materials.—				
From Hong-Kong ...	79,000	13,000	–	66,000
,, Great Britain ...	171,000	88,000	–	83,000
,, United States ...	23,000	66,000	+	43,000
,, Denmark	2,000	25,000	+	23,000
,, Japan	65,000	378,000	+	313,000
,, Other countries ...	70,000	41,000	–	29,000
Total	410,000	611,000	+	201,000
Aluminium, manufactures of.—				
From Great Britain ...	1,000	—	–	1,000
,, United States ...	1,000	7,000	+	6,000
,, Russia	1,000	—	–	1,000
,, Japan	7,000	25,000	+	18,000
,, Other countries ...	—	5,000	+	5,000
Total	10,000	37,000	+	27,000

LEGAL.

A.E.G. British Companies to be Wound up.

In the Chancery Division on Tuesday, Mr. Justice Younger had before him the petition of the Board of Trade to wind up under the Trading with the Enemy (Amendment) Act, 1916, the A.E.G. Electrical Co. of South Africa, Ltd.

Mr. Austen-Cartmell said this was one of the group of companies controlled by the A.E.G., a well-known enemy concern, and practically the whole of the shares were held by the German company, and the business was controlled by that company. At the outbreak of the present war the capital was £100,000, 19,995 of the 20,000 shares being held by the German company. Of the remaining five, one was held by a German, and four by persons with addresses in England. A vesting order was made, and the custodian had transferred the whole of the shares into his name. Formerly the directors were two English, and two resident in Berlin, but latterly three were resident in Germany. The main sphere of the company's operations was in the Union of South Africa, and it dealt in electrical appliances, and supplied power installations. The assets and liabilities in South Africa had been dealt with by a firm appointed for the purpose in that country, and they had in hand about £500 or £600. In England £16,000 had been handed over to the Public Trustee, and there was in hand £4,000. The sum of £48,000 was claimed by the English business as against the German company, and £81,000 was stated to be due by the South African Co. to the German company. These companies, said counsel, were formed solely for running the business of the German company in Great Britain and the Dominions, and the Board of Trade now asked that, the business having been disposed of, the company itself should be wound up.

His Lordship said he thought this a very proper case for a winding up, and made the order.

His Lordship made a similar order in the case of the Electrical Co., Ltd.

Mr. Austen-Cartmell said this was another of the group of three companies controlled by the A.E.G. In this case, out of a total of 20,000 shares, 19,991 were held by the German company. The company was incorporated in 1892 to take over another business which had been acquired by the A.E.G., the directorate being identical. This company was engaged in wholesale trade in electrical appliances only in this country. The third company, which would have to be dealt with later, the A.E.G. Electrical Co., Ltd., carried on business anywhere. In the present case the controller had handed £46,000 to the Public Trustee, and there was £3,000 in cash. The sum of £20,000 was alleged to be due to the German company.

His Lordship made the order as stated above.

Stevens *v.* Telegraph Construction & Maintenance Co., Ltd.

In the City of London Court, on May 27th, before his Honour Judge Atherley-Jones, K.C., this case under the Workmen's Compensation Act was mentioned. Applicant, Alice Ellen Stevens, coil tester, made a claim through her father, as her next friend, against the respondents, for damages sustained through an accident that befell her while working for them on November 23rd at Enderby's Wharf, East Greenwich, when she received an electric shock. She was injured by catching hold of a live cable, suffering burns on the thumb, and the middle, ring, and little fingers of the left hand. She was still totally incapacitated, but anticipated that in three months she would recover sufficiently to resume work. Her wages had been 30s. per week.

Miss Stevens said that the insurance company had now stopped the 16s. half wages which she had received as part compensation. The respondents had now paid £45 into Court, which she was prepared to accept in full satisfaction of all her claims, and she asked that the money should be paid out to her.

Judge Atherley-Jones said he could not accede to such a suggestion, as the girl was under age.

Her father pressed the Judge for payment of the money, and said he had been keeping his daughter for the past seven months. Her hands were so much injured that she could not do any work yet.

Judge Atherley-Jones: Then you should not have accepted the £45 if the girl cannot work. I cannot hand the money over to you. You can have £10, but I shall not do any more.

The Father: Can't I have my day's expenses?

Judge Atherley-Jones: I have no power to give it you. You can take it out of the £10. The balance will remain in Court for the girl's benefit later on.

BUSINESS NOTES.

Trade Announcements.—Messrs. Fyfe, Wilson & Co. have removed to new offices at 133, West Campbell Street, Glasgow. Their telephone numbers and telegraphic address are unaltered.

Mr. G. W. Warriner, electrician, of 14, Parliament Street, York., announces that he is giving up the business, owing to his premises having been taken over by the Government.

The London Electric Firm, of Brighton Road, Croydon, are now making, and are able to supply, gun-metal, brass, and aluminium castings in their new model foundry.

Millns Electrical Co. have this week removed their offices and works from Strand to 17, Whitefriars Street, E.C. 4.

Australian Contracts.—An Act which has recently been passed by the Government of Victoria relates to the purchase of goods, machinery, or materials for works undertaken by or on behalf of certain local authorities. Goods, machinery and materials, &c., to the amount of £250 and upwards, required by local authorities are to be purchased from the manufacturers, &c., in the Commonwealth, unless it can be shown that they are unprocurable, or procurable at an unreasonable price or within an unreasonable time, &c. No goods to which the Act applies may be imported except under a certificate from the responsible Minister.—*Board of Trade Journal.*

Moonlight Chart.—Messrs. C. A. Vandervell's moon chart for June, compiled by their chief engineer, Mr. A. H. Midgley, has come to hand.

Trade Inquiries.—A firm of engineers at Santander, Spain, desires to take up agencies for all Spain, for United Kingdom manufacturers of electric plant and steam turbines. [Reference No. 138].—*Board of Trade Journal.*

Liquidations.—Bosch Magneto Co., Ltd., London.—First and final dividend of 20s. in the £, payable at the office of the Official Receiver and Provisional Liquidator, 33, Carey Street, W.C. 2.

Malta Tramways, Ltd.—Voluntary liquidation. Mr. J. R. Tulloch, 4b, Frederick's Place, Old Jewry, E.C., liquidator. Meeting of creditors June 5th.

W. P. Theermann & Co., Ltd., Manchester.—The Controller, Mr. W. Eaves, 15, Fountain Street, Manchester, has applied for his release.

Southport Tramways Co., Ltd.—Winding up voluntarily. Messrs. T. Bower and H. A. Stagg, Manchester Hotel, London, E.C., liquidators. Meeting of creditors, June 10th.

American Price for Copper.—The New York correspondent of the *Times* states that the War Industries Board has continued the fixed price of copper at 23½ cents for 75 days, but some producers have refused to accept this figure, and expect to gain a system of differentials benefiting those who produce at a high cost.

Chile.—With a view to giving effect to the general desire for the development of the iron and steel industry in Chile by the opening of many fresh ironworks, the Empresa de los Altos Hornos de Corral has applied to the Chilean Government for a loan of 10,000,000 pesos, offering as guaranty its properties, concessions, and future income. The application has the support of the Sociedad de Fomento Fabril (Industrial Development Society), and will probably be granted.

Italy.—The Conti Electric Co., of Milan, has voted the increase of its capital from 30,000,000 to 46,000,000 lire to defray the cost of various extensions under way and projected. The Società Emiliana, of Parma, has issued fresh capital of 1,400,000 lire in order to develop tramways in Parma and province in conjunction with the Compagnia Nazionale di Transporti e Comunicazioni. The Società delle Tramvie e Ferrovie Elettriche di Roma has increased its capital from 3,500,000 to 8,250,000 lire, and the Società Anonima Brevetti Perego, of Milan, has doubled its capital to 1,000,000 lire.

For Sale.—Hull Corporation electricity department has for disposal a quantity of plant (generator sets) removed for the installation of larger units. Particulars are given in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Arklow (Co. Wicklow). — Public Lighting. — The Council has appointed a deputation to wait on Messrs. Kynoch, with a view to having the town lighted by electricity.

Batley.—Price Increase.—The Corporation electricity department has given notice that from July 1st the charges will be increased as follows:—For lighting by 5 per cent. on present rates (*i.e.*, 20 per cent. on pre-war charges): for power and heating by 12½ per cent. on present rates (*i.e.*, 40 per cent. on pre-war charges).

Bury.—Year's Working and Price Increase.—The result of the year's working of the Corporation electricity works shows a profit of £1,626. A sum of £1,000 was placed to the relief of rates, and the balance to the reserve fund. The Electricity Committee has decided to increase the charge for electricity by a further 10 per cent. as from July next.

Caerphilly.—Public Lighting.—The U.D.C. has accepted the terms of the South Wales Electric Power Co. for public lighting at Nelson. The existing lamps are to be converted to electricity, and are to be lit at £2 10s. per 50-c.p. lamp per annum, with the addition of the war emergency charge of 25 per cent., subject to increase or decrease according to fluctuations in prices.

Dublin.—Electrical Power at Dublin Docks.—At last week's meeting of the Dublin Port and Docks Board, the engineer reported that the work of providing electric power for the War Department hay-pressing installation at the North Wall Dock area would be done at the cost of the military authorities. Alderman Byrne, M.P., said the Corporation should get the same facilities for supplying electricity as the Dublin United Tramways Co., or any other body, and, as a member of the Corporation Electricity Supply Committee, he strongly objected to the action of the Government in pampering other companies against a popularly elected body. The chairman (Alderman Moran) said if they had the entire output of the Corporation power house at the North Wall it would not have a wheel, as the current was alternating, and the Tramway Co.'s current was continuous. "If the Corporation had the same facilities as the Tramways Co., could the Corporation do it then?" asked the Lord Mayor of Dublin (Mr. L. O'Neill). The chairman said they could if they could get rotary converters, and if they went to the expense of putting them down: but it would be very foolish to trouble in that way for the sake of what would be a temporary measure. As soon as the Corporation could supply energy to the area at the docks, he (Alderman Moran) would be the first to see that they would get what it was their right to get.

Edinburgh.—Electricity Supply.—A Conference was held, last week, between the E.L. Committees of Edinburgh and Leith, in reference to the supply of electric power and future developments. At present the stations of both Corporations are fully loaded, and it was suggested that if the Ministry of Munitions would consent to an instalment of the work of the new station at Portobello, Leith could be supplied from this station. A Committee was appointed to prepare a report on the proposals made at the Conference.

At a meeting of Edinburgh Corporation, later in the week, Mr. Bruce Lindsay moved a recommendation by the Electric Lighting Committee that a deputation urge on the Minister of Munitions the necessity of provision being made at an early date to meet the needs of their area of supply. It was stated to them in London on their last visit that if there was sufficient power in their stations for industrial purposes the Ministry of Munitions did not care a straw whether the city was lighted or in darkness. In the course of a discussion it was pointed out that the Government was holding its hand, and was waiting until some policy for the country at large had been formulated. The Lord Provost said they wanted one of the super-stations to be established in the Edinburgh area. Mr. Bruce Lindsay remarked that their station at Portobello fulfilled all the requisites of a super-station to the very utmost. The recommendation to send a deputation was adopted.

Heston and Isleworth.—Increased Power Demand.—The Electricity Committee of the U.D.C. reports that the increased demands now being made upon the electricity undertaking for power have necessitated consideration of the question of increasing to the utmost the efficiency of the plant at present installed at the electricity station. The Committee has directed that combustion chambers be fitted to the boilers at present heated by the refuse destructors. By this means the boilers in question will, in cases of necessity, be heated by coal fires in addition to the heat derived from the destructors.

Keighley.—Wages Advances.—Wages advances recommended by the Corporation Electricity Committee are as follows:—Men aged 18 and over, from 15s. to 19s. per week above pre-war rates; men under 18, 2s. per week advance, with a maximum of 10s. per week over pre-war rates. The increases to be regarded as war wages, and payable on overtime and night duty, Sundays, and Bank Holidays, commencing as from the first full pay-day after March 21st, 1918.

London.—St. Pancras.—The chief electrical engineer reported, with reference to the proposed installation of two additional 3,000-kw. Ljungström turbines at the King's Road station, that he applied to the Ministry of Munitions for sanction to this work being carried out, and had been informed that they were only prepared to consider an application for one set. He had also approached the Coal Controller, who stated that he could not support the application for the two turbines. If one set only were proceeded with, the estimated cost would be £24,800, as against £41,900 for the two sets, in consequence of all the pipe work and circulating water arrangements having to be the same for one set as for two. The Electricity Committee has considered the foregoing, and decided that as soon as the approval of the Ministry of Munitions is received, a contract be entered into with the Brush Electrical Engineering Co., Ltd., to provide either one or two Ljungström turbines, at a cost of £17,900 each.

Manchester.—Annual Estimates.—The estimates of the Corporation Electricity Committee for the year ended March 31st, 1919, show proposed capital expenditure £240,000, made up as follows:—Generating stations: land, buildings, machinery, &c., £140,000; distributing stations: land, buildings, machinery, &c., £36,000; mains and services, £63,500; motors, £500; as compared with a total approximate expenditure of £245,958 for 1917-18.

Nuneaton.—Year's Working.—At a meeting of the Town Council, it was reported that the accounts for the past year of the electricity undertaking showed a loss of £2,000. Alderman Melly stated that at the next meeting of the Committee it might be necessary to increase the charges.

South Africa.—Johannesburg.—Press dispatches show that, during the past week, the success of the Johannesburg electricians in the recent strike has led to agitation among miners and mechanics working in the Witwatersrand mines, whose Federation holds that they are entitled to the same rate as the electric power station men (£8 10s. weekly). A mass meeting of Trade Unionists was held on Sunday. Other reports show that the Johannesburg strike has been resumed. It is stated that the Municipal Council agreed to the strikers' terms with the greatest reluctance; the voting in favour of acceptance was 14 votes and 13 against. It was feared that had the strike continued it would have then involved the men engaged in the mines, which, apparently, it has now done, and the employés at the Victoria Falls Power Works.

Worcester.—Street Lighting.—The Watch Committee has decided not to use the street electric arc lamps in June, July, and August, excepting for the dark hours, in the centre of the city.

TRAMWAY AND RAILWAY NOTES.

Burton-on-Trent.—A Burton and Ashby electric light-railway car was struck by lightning whilst travelling through the fields between Bretby and Sunnyside, and caught fire, which was extinguished by sand.

Canada.—Increased Wages.—The employés of the Montreal Tramway Co. having failed to obtain increased wages have threatened to strike; the Mayors of the different municipalities served by the tramway are considering the suggestion of the company that they should be allowed to charge a fare of 2½d., so that the increase may be granted.

Croydon.—Obstinate Drivers.—According to the *Evening News*, two tramcars met on a single track at Northcote Road, and neither driver would give way; the traffic was consequently held up. The drivers, who each accused the other of being in the wrong, for 20 minutes treated a policeman's order with indifference. The men were summoned on Tuesday for improperly delaying the cars. It was stated that both had since been discharged. Both men were fined; one who should have retired was ordered to pay 40s., and the other 20s.

Continental.—Italy.—There has been formed at Bergamo the Società Anonima Ferrovia Valle Seriana, with a capital of 5,000,000 lire, with the object of taking over the concession of the General Economic Railway Co. of Brussels, for the Seriana railway line and its lengthening to Bondione; also that of the Ponte Nossa to Clusione line from the company of the same name, and electrifying the same.

Elland.—Storm Damage.—A tramcar on the West Vale route was struck by lightning during one of the severe storms which swept over the West Riding last week. No personal injury resulted, but the car was disabled and had to be towed back to the sheds, and the two cars which undertook this work were somewhat damaged in the course of the stiff climb up the Ainleys. Between Cowlersley and Slaithwaite the heavy rain washed sand from the hills on to the rails on three sections of the route, and the service of cars was disorganised.

Fuel Economy.—According to the *Journal* of the Tramways and Light Railways Association, referring to the Order of the Tramways (Board of Trade) Committee that tramway undertakings must reduce their coal consumption at once by at least 15 per cent., the following means of economising coal are suggested:—(1). Reduction of services not required in the national interest. (2). Withdrawal of services either for a part or the whole day on Sundays. (3). Stopping all services at an earlier hour in the evening. (4). Partial substitution of coke, locally produced, for the coal at present consumed. (5). Grant of a bonus to motormen for economy in power consumption.

Glasgow.—Traffic Returns.—The revenue of the Corporation tramways to date for the current financial year, up to within a fortnight of its close, amounts to £1,349,081, being an increase over the corresponding period of the previous year of £153,904, or a weekly average increase throughout the year of over £3,080.

London.—Tramway Receipts.—The L.C.C. tramway receipts for the week ended May 22nd amounted to £72,085, compared with £55,036 in the corresponding week last year. The receipts include money taken on five days under the new fare scales, while Whit Monday is also included, and these factors to some extent account for the large increase.—*The Times.*

It is stated that for the first time for many years the Waterloo and City Railway under the Thames is being repaired. The work consists of renewing piping, &c., for the pumping machinery which takes care of the drainage throughout the whole length of the tunnel. The work is carried on at night when the traffic is stopped. The pumps are all electrically controlled, and operate automatically.

Mexico.—New Railway.—An application is pending before the Department of Communications and Public Works for the construction of an electric railway connecting Tampico with Mexico City, passing through the capitals of the States of Vera Cruz, Tlaxcala, and Puebla, as well as many other important towns.

Southend.—Parcel Service.—With regard to the inquiry of the Board of Trade as to the possibility of establishing a parcel delivery service as an auxiliary to the tramway service, the Light Railways Committee has come to the conclusion that it has no facilities for complying with such a scheme.

TELEGRAPH AND TELEPHONE NOTES.

Brazil.—According to a U.S. Consular report the Government-owned telegraph lines of Brazil presented a marked improvement during 1917 as compared with previous years. The receipts have increased from $3,787,685 in 1913 to $4,324,587, and the expenditure has diminished from over $7,000,000 to $4,816,817 in 1917, while the deficit has been reduced from $3,280,048 to $492,230.

Mexico.—A new wireless station has been established on the Island of Lobos, off the coast of Tampico, largely for the purpose of affording the various petroleum companies facilities for communicating with their vessels over great distances at sea. This station will be able to communicate with the wireless stations at Mexico City, Tampico, Vera Cruz, &c., and by way of Havana with various stations in the United States. It is expected to prove of great value in advancing the commercial interests of the Republic.

Spain.—In our issue of May 10th we mentioned that wireless telephone installations had been placed on board the two Spanish merchant boats *Jaime I* and *Raimundo Lulio*. The trials since carried out at a distance of 100 miles apart have proved very successful, and other boats at Bilbao and Barcelona are being fitted up with the apparatus. The makers of the plant, La Compania Iberica de Telecomunicacion, of Bilbao, declare this to be the first successful wireless telephone installation in the world. The Spanish Admiralty has followed the trials with interest, and it is hoped will lend its aid for further experiments.

Telegram Delivery.—The Postmaster-General has again drawn the attention of those with registered abbreviated addresses to the advantages of receiving by telephone telegrams directed to an abbreviated address. An appreciable saving of time results from this method of delivery, and it also sets free boys for other work. Any registrant willing to accept delivery of his telegrams by telephone should communicate in London, Dublin, and Edinburgh with the Secretary, and in the Provinces with the postmaster of the town at which his address is registered.

The Postmaster-General announces that on and from June 1st next the charges for recording instructions in connection with the delivery of telegrams (in addition to the charge of one guinea a year for a registered telegraphic address) will be as under:—

(*a*) Five shillings for each special instruction relating to the delivery of telegrams bearing a registered abbreviated telegraphic address.

(*b*) One shilling for each instruction relating to a change of address, whether for telegrams bearing a registered address or a full address. If the record is required for a longer period than one calendar month, one guinea a year will be payable.

Wireless Strike.—As briefly mentioned in our last issue, the operators represented by the Association of Wireless Operators have given notice to cease work at the end of next week. Their grievance is the delay of the National Wages Board of the Ministry of Shipping in dealing with their claim to increased wages, the only increase so far granted having been 5s. a week in October last. An operator starts at £5 a month, rising to £6 by two annual advances.

CONTRACTS OPEN AND CLOSED.

OPEN.

Ashton-under-Lyne.—June 5th. Engine slack for Electricity Committee. Borough Electrical Engineer, Wellington Road.

Belfast.—June 7th. Electricity Department. 9,000 yd. of 6-core 0·1 sq. in. lead-covered, paper-insulated cable, and laying. See "Official Notices" May 24th.

Erith.—Electricity and Tramways Department. 500-kw. rotary converter with transformers, switchgear, &c. See "Official Notices" May 17th.

Glasgow.—June 4th. Electricity Department. 30,000 tons of coal (singles and pearls). Mr. W. W. Lackie, 75, Waterloo Street.

Newcastle-under-Lyme.—Electricity Department. One 150-kw. rotary or motor-converter set and switchgear. See "Official Notices" May 24th.

South Africa.—June 10th. South African Railways and Harbours Administration. 59,500 incandescent train lighting lamps with solid wire drawn tungsten filament; 30,761 incandescent lamps with solid wire drawn tungsten filament; and 3,600 incandescent lamps with carbon filament. (Tender No. 151.) Secretary to Tender Board, South African Railways Headquarter Offices, Johannesburgh.

A copy of the specification, &c., may be consulted by British firms interested at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence).

Warrington.—June 18th. Electricity and Tramways Committee. High-tension lead-covered cable and medium-tension rubber-covered cable. See "Official Notices" to-day.

CLOSED.

Glasgow.—The Tramways Committee recommends acceptance of the offers of Hadfields, Ltd., and Edgar Allan & Co., Ltd., for special track work, also that contracts be entered into with the following (for six months in the majority of cases):—

Steel axles, tires, and wheels.—H. Bessemer & Co., Ltd., and Brown Bayley's Steel Works, Ltd.
Chilled-iron brake blocks (three months).—Carron Co.
Fire-clay goods (six and 12 months).—Spiers, Gibb & Co.; Glenboig Union Fire-clay Co., Ltd.
Rubber and asbestos goods.—N.B. Rubber Co., Ltd.; Clyde Rubber Works, Ltd.; George M'Lellan & Co.; Rubber Co. of Scotland; J. T. Goudie and Co.

The Electricity Committee has accepted the following tenders:—

Cast-iron boxes, section pillars, &c. (for six months).—Carron Co.; Falkirk Iron Co., Ltd.; Lion Foundry Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.; British Westinghouse Co., Ltd.; Aron Electricity Meters, Ltd.
Single cables.—Callender's Cable Co., Ltd.
Concentric and triple-concentric cables.—Callender's Cable Co., Ltd.
H.T. cables.—W. T. Glover & Co., Ltd.
E.H.T. cables.—Callender's Cable Co., Ltd.
Rubber-covered cables and flexibles.—Craigpark Electric Cable Co., Ltd.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, June 1st. Visit to Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton.

Roentgen Society.—Tuesday, June 4th. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi. Annual general meeting. Paper on "An Investigation of the Photographic Action of X-rays," by Mr. N. E. Luboshey.

Chief Technical Assistants' Association.—Thursday, June 6th. At 6.15 p.m. Paper on "Distribution Faults and their Location," by Mr. Ingram.

NOTES.

Official and Small Advertisements.—Provincial readers will oblige by posting their communications early on Wednesday, so as to ensure their arrival by the first post on Thursday, as there is sometimes considerable delay in the postal deliveries.

Electric Power Supply.—On the point of going to press, we learn that the Report of the Board of Trade Electric Power Supply Committee has been issued. (Cd. 9,062. Price 3d. net.) The Committee recommends the establishment of a national system of electric power supply, controlled by a body of State Commissioners, and administered by District Boards, who would be responsible for the generation and distribution of electricity in their several areas.

The Commissioners would take over the existing powers of the Board of Trade, Local Government Board, L.G.B. for Ireland, and Scottish Office, with large additional powers; the existing system of generating electricity separately for small areas would be abolished, and the District Electricity Boards would purchase all generating stations of authorised distributors in their areas, but existing undertakers would, if they so desired, retain the distribution within their respective areas. The Boards would make no divisible profits, and would be financed by funds raised with Government assistance. Largely extended powers would be granted for the use of overhead wires, wayleaves, and the acquisition of water rights.

On the evidence submitted, the Committee unanimously concludes that the present system is contrary to the national interest, wasteful of fuel resources, and detrimental to industry. It recommends immediate action, in the interests of industry, and that the Government should provide funds for the purpose.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending June 9th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Monday, June 3rd.—No. 3 Company, 6.30—8.30, Recruits' Drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, June 4th.—Lecture on "Demolitions," 6.30. Physical Drill and Bayonet Fighting, 7.30.

Wednesday, June 5th.—No. 1 Company, Drill, Knotting, &c., 6.30—8.30. Recruits' Drill, 6.30.

Thursday, June 6th.—No. 2 Company, Drill, Knotting, &c., 6—8. Recruits' Drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. First Field Dressing Demonstration, 6. Band Practice, 7.

Friday, June 7th.—Musketry for the whole Corps, 5.30—8.

Saturday, June 8th.—Entrenchments, &c., for the whole Corps, 2.45—4.45. Recruits' Drill 2.45—4.45.

Sunday, June 9th.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Drill order, with haversacks and water-bottles. Rifles. Mid-day and tea rations to be carried.

C. HIGGINS, *Capt.* R.E., T.F., *Adjutant.*

A Professional Workers' Union.—After conferences in which representatives of many organisations took part, a Federation of Professional, Clerical, and Technical Workers has been formed "to assist in maintaining and improving the economic conditions of members; to discuss policy on subjects of common interest, and, where necessary, to take joint action; to arouse general interest on important professional matters affecting particular organisations, and generally to secure the unity of members in all social activities." The hon. secretary is Mr. F. H. Norman, Westfa, Princes Park Avenue, N.W. 4.—*The Times.*

A 75,000-H.P. Turbo-generator.—According to the *Daily Mail* the German A.E.G. asserts that it is now building the largest and most powerful turbo-generator ever constructed. It will generate 50,000 KW., representing 75,000 H.P. The German Press acclaims the feat as a "colossal achievement" in the midst of war and in view of the shortage of important raw materials, especially nickel. The German Press may be interested to learn that turbo-generators of 50,000, 60,000 and 70,000 KW. are being built in the United States.

The Electric Heating of Moulds.—In a paper to be read at the spring meeting of the American Society of Mechanical Engineers next week, Mr. H. E. White describes the application of electric heating to moulds for the forming of synthetic insulating materials to shape. These materials soften sufficiently at a moderate temperature to take the shape of the mould, and when heated to a higher temperature undergo chemical changes which harden them. Live steam had been used for heating the moulds, which were afterwards cooled with water, but the process was slow and liable to interruption through leakage, &c. Electric heating was tried, and proved so successful that the use of steam was abandoned. The method adopted was that of magnetising the moulds with alternating current by the induced eddy currents and hysteresis, the steel moulds being encircled with a coil of 100 turns of No. 6 asbestos-covered wire, connected to the 220-volt supply mains. Moulds weighing 10 to 15 lb. were brought up from cold to the curing temperature in three to five minutes by this means, the magnetising coil remaining quite cool. The attainment of the right temperature was indicated, in the first instance, by the colour of sulphur melted in contact with the mould, or by the charring of cane-sugar syrup mixed with a little blue litmus. Illustrations in the paper show how the coil was best applied, in two sections, one on each part of the press, so that the moulds could be put into the press as easily as in the case of an ordinary press. The faces of the press were laminated to reduce heating where it was not required, and the author considered that more than half the heat developed appeared in the mould. With this method of heating, several moulds could be piled one on top of the other and all heated at once: the moulds also could be of the simplest form and very inexpensive. The method could also be applied to die castings of readily fusible metal, tempering steel, &c.

"Attracted" the Lightning.—According to the *Sussex Daily News*, during a recent thunderstorm a discharged soldier, Mr. H. C. Fowler, had a narrow escape from death. He had been undergoing electrical treatment to his right arm, and a flash of lightning, *apparently attracted by the electricity in his body*, struck him, spun him round, and threw him to the ground, rendering him unconscious. His right arm was drawn up to his shoulder, and remained a fixture. He was taken to the Military Hospital, where he was treated by Capt. Ray, and had to have his arm forced down. It is feared the limb will always be affected in consequence. Apparently the victim—one of our Mons heroes—had not been completely discharged, after all.

The Electric Vehicle Committee.—The Electric Vehicle Committee, acting in conjunction with the Accumulator Makers' Section of the British Electrical and Allied Manufacturers' Association, having represented to the Controller of the Priority Department of the Ministry of Munitions the desirability of increasing the amount of new lead allowed to be used in the repair and maintenance of batteries under the Special Battery Permit issued to the accumulator manufacturers, where batteries for electric vehicles are concerned, the Controller has now consented to an addition to Clause 15 of the Special Battery Permit held by members of the Accumulator Makers' Section of the B.E.A.M.A., to come after the words: "Not exceeding 1 cwt.," the words "Or in the case of electric storage batteries used as the motive power for propelling electric vehicles 3 cwts., and provided always, &c." This addition has been designed to enable accumulator manufacturers, who are makers of electric storage batteries for use on electric vehicles, to repair and maintain the same without the necessity of individual application for permits being made to the Priority Department.

Electrical Trades Union.—The annual conference of the Electrical Trades Union was held in Blackpool during Whit week, under the presidency of Mr. W. J. Ball, of Manchester. Some 23,000 members of the electrical trades were represented, some 200 delegates being present. On Thursday, last week, an important step was taken with reference to Man Power. The conference sent a telegram to the Minister of Munitions, pointing out to him the injustice to members of the Union through the revision of the list of protected occupations, and requesting him to meet a deputation. A reply was received, agreeing to meet a deputation in London during the present week.

Composite Insulating Materials Investigation.—A Joint Committee representing the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers Association, appointed under arrangements with the Department of Scientific and Industrial Research, has been considering a draft specification applicable to composite insulating materials used fo electrical work in general (exclusive of vulcanised material), and invites manufacturers of such to consider the supply to the Committee of a series of moulded test specimens of their products which would be paid for.

The principal object of the tests is to obtain figures for existing standard grades of composite insulating materials now on th market, from which data will be available for filling in the draf specification. A set of moulds is now being completed for use i making the specimens. It is probable that priority will be obtainable for this work.

Manufacturers who have not already communicated with th Institution can obtain full particulars from the Secretary.

The I.M.E.A. Meeting.—We have received, at th moment of going to press, the programme of arrangements for th annual meeting, which is to be held at Manchester on June 20t and 21st. After the welcome by the Lord Mayor, Mr. Watso will read his presidential address, and Mr. Pearce will follo with his introduction of the discussion on "The Future o Electric Power Supply." After the adjournment the afternoon o Thursday, June 20th, will be devoted to visits to Stuart Stree station and the Westinghouse works. A concert at the Engineer Club will be held at 8 p.m. On Friday the discussion on electri power supply will be resumed and the annual general meeting wi be held.

Electric Power Supply of Great Britain.—A pamphle with this title, containing a report of the debate which was hel at the Engineers' Club, Manchester, on March 5th, 1918, on th interim report of the Coal Conservation Sub-Committee has ju been issued. Copies may be had on application to the Hon. Secr tary, the Engineers' Club, Manchester, price 4d. each, includin postage.

London Association of Foremen Engineers.—At the sixty-fifth anniversary festival of the Association, which took place recently, the attendance of members and visitors was so large that an overflow hall had to be utilised. The gathering was presided over by Sir Hugh Bell, the vice-chairman being Mr. Anthony A. A. Byrd, President of the Association. Dr. Addison, Minister of Reconstruction, sent a telegram expressing regret that he was prevented from attending the dinner.

The chairman addressed a telegram to the King, expressing the loyalty and devotion of the members of the Association, and asserting their determination to exert every effort to maintain the output of munitions and other supplies necessary for the attainment of a decisive and lasting peace, and a reply from the King's Private Secretary expressed his appreciation of their loyal and patriotic assurances.

Proposing the toast of the "Allied Forces," Lieut.-Col. Norton Griffiths warned the company against the dangers arising from insidious German peace propaganda. Victory alone could ensure the future peace and prosperity of the world.

Mr. Robert F. Skinner (the American Consul-General), quoting official American figures, said the total amount of their steel construction programme on March 1st was 8,205,708 dead-weight tons. Of this total approximately 28 per cent. had been completed. The amount of floating tonnage exceeded the American total output in 1916 by approximately 50 per cent.

The chairman, in proposing "Prosperity to the London Association of Foremen Engineers," said that one of the difficulties to be overcome in the conduct of business was for employer and employé to understand the point of view of the other side. They must all bear in mind that the point was the cost of the finished article, and not the cost of the men's time. How many disputes would disappear if they would only remember that! To those who stood between the employer and the employed, like the foremen engineers, they owed a debt of gratitude which it was quite impossible to exaggerate.

Mr. James Harrington responded on behalf of the Association, and announced donations to the Association's Superannuation Fund of £430.

Mexican Ores. — Investigations have disclosed the presence in Sonora of extensive deposits of sulphate of molybdenum and of tungsten. These deposits will be developed upon an extensive scale.

Legal.—THE ASSAULT ON A NON-UNION MAN.—At the Clerkenwell Sessions, on Wednesday, before Sir Robert Wallace, K.C., and a jury, Albert Ed. Owen and Geo. Wm. Turner, both in the employ of the New System Private Telephone Co., Ltd., of Great Portland Street, W., were indicted on a first count—"That on April 29th they used violence to or intimidated or followed with two or more persons in a disorderly manner in or through Euston Road one Albert Edward Muller, with a view to compel him, the said Albert Edward Muller, to abstain from doing an act which he had a legal right to do—namely, to follow his lawful employment." There was a second count against Albert Ed. Owen of having committed a common assault on Albert Edward Muller. Mr. Patrick Hastings appeared as counsel for the prosecution, and Mr. Zeffertt, barrister, again represented the prisoners, who had been out on bail. The proceedings at the Police Court have already been reported in the ELECTRICAL REVIEW.

At the outset of the proceedings, Mr. Zeffertt objected to the first count, and Mr. Hastings said he thought the objection could be met by making it one of intimidation only. This Mr. Zeffertt said he could agree to, but it meant that there would have to be separate counts, and they could not be tried together.

Sir Robert Wallace, K.C., said that would be so, and to avoid any further trouble perhaps the case against Owen could be taken first and the other one adjourned.

Mr. Zeffertt said he did not want any adjournment.

Mr. Hastings said if his friend would agree to the trial of Owen alone it would meet the case, as, if the defence succeeded, nothing further would be heard of the case against Turner. This course was agreed upon, and Turner was ordered to leave the box, and released on his own recognisances. The trial of Owen was proceeded with. Mr. Hastings then addressed the jury.

After a very full hearing, Sir Robert Wallace addressed the jury, and said they had nothing to do with Trade Unionists or non-Trade Unionists. A man was entitled to join them or leave them alone in this country. All they had to decide was whether Owen deliberately struck this man or whether he was struck by Muller, and anything that followed was a general altercation. They had nothing to do in this country with Trade Union disputes when a case of common assault was in issue. They had the evidence of Turner that they were quite legitimately trying to persuade Muller to join the Union, and there was a little pushing. On the other side of the road was Owen and others, it was said, and it was alleged that Owen was beckoned for, and, coming up, deliberately struck the prosecutor. If they believed that story the consequences followed. The striking of his head on the kerb was the result of the blow, it appeared. Muller said there was no argument and no dispute. On the other hand, the defendant said that Muller was very offensive, and struck him. If that was true, there would not be much surprise if Owen struck back. One was not entitled to strike another man; but he left it to the jury to say whether it was surprising to do so under the conditions. It hardly mattered whether the telephone actually hit Owen, as it amounted to the fact that the man that started a row must not be surprised at what he got. His Lordship concluded by saying they were not trying Trade Unionism, but a common assault, and if they had the very least doubt about it, they would, of course, give the defendant the benefit of it.

The jury considered for about four minutes, and then found the prisoner "Guilty of a very serious assault."

Sir Robert Wallace said he presumed the object of the prosecution had been attained, and if the prisoner would agree not to molest or attempt to molest the prosecutor in any way, that was all they required.

Mr. Hastings: That is so.

Addressing the prisoner, Sir Robert Wallace said he quite agreed with the verdict—in fact, he might say absolutely. It was a very serious matter to interfere with a fellow-workman whether he was actuated by Trade Union motives or not. The question was whether he would agree not to molest again, in which case he would bind him over to come up for judgment if called upon.

The prisoner said he would willingly agree to that.

Sir Robert Wallace: If you violate that promise you will get six months' imprisonment.

Prisoner was then bound over.

Turner was then put in the dock, and, on his pleading "Not guilty," it was stated that the firm did not intend to proceed further with the prosecution.

Sir Robert Wallace accordingly discharged him.

The Foreman of the Jury: It is more than he deserves.

Appointments Vacant.—Engine drivers (45s. 4d.) for the Tunbridge Wells electricity works; fitter-driver for Diesel engines for the Sale U.D.C. electricity department; switchboard attendant (60s. + 12½ per cent.), charge engineer (£180 + 12½ per cent.) for the Derby Corporation electricity department; assistant electrical engineer and tramway manager (£200) for the Keighley Corporation electricity department; two junior engineers in charge (£2 + 20s. and 12½ per cent.) for the Bolton Corporation electricity department; test-room assistant (50s.), overhead lineman (56s. 4d.), skilled fitter as foreman for the Burgh of Kilmarnock electric lighting and tramway department; armature winder for the Rawtenstall Corporation tramways department; shift engineer (74s. 9d.) for the Hoylake and West Kirby U.D.C. electricity station; junior shift engineer for the Gravesend Corporation electricity department. See our advertisement pages to-day.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the May meeting of the Association, Mr. Geoffrey Porter referred to the importance at the present time of the great saving in the transport and consumption of coal effected by the use of oil fuel in Diesel engines in place of steam-generating plant. As the electricity supply undertakings that had installed Diesel engine plant were already effecting a saving in coal consumption far greater than the proportion aimed at by the Board of Trade in the recent Order of the Gas and Electricity Restriction Committee, he urged that such undertakings should be exempt from the operation of the Order. He proposed the following resolution, which was seconded by Mr. J. E. Edgecombe and unanimously passed by the meeting:—

"That application be made by the Diesel Engine Users' Association to the Gas and Electricity Restriction Committee of the Board of Trade to exempt from the provisions of the Lighting, Power and Heating Order, 1918, all public electricity supply undertakings in which Diesel oil engines are utilised."

It was further decided that copies of this resolution be sent to the Coal Controller and to the Institution of Electrical Engineers.

A paper by Mr. H. Moore on "Tar Oil in Diesel Engines" was read and discussed. Mr. P. H. Smith's paper on "Two Essential Conditions for Burning Tar Oil in Diesel Engines" was also presented, and is to be discussed at a later date.

Institution of Electrical Engineers.—The election of new members of Council has resulted as follows:—

President.—Mr. C. H. Wordingham.

Vice-Presidents.—Mr. W. A. Chamen, Mr. R. A. Chattock.

Hon. Treasurer.—Mr. J. E. Kingsbury.

Ordinary Members of Council.—Mr. H. W. Clothier, Mr. D. N. Dunlop, Sir R. A. Hadfield, Bart., F.R.S., Prof. E. W. Marchant, D.Sc., Mr. C. C. Paterson, O.B.E., Mr. J. Sayers.

At the meeting on Thursday, last week, the president announced that a Committee had been appointed to watch the proposals for rationing coal, gas, and electricity, and to place the views of the Council before the proper authorities.

The report of the Committee of the Students' Section states that the average attendance at the meetings has been 52, the highest recorded being 185. The opening address was delivered on November 23rd, 1917, by Sir Oliver Lodge, who gave a very interesting discourse on "Astronomical Applications of the Electrical Theory of Matter." The president (Mr. C. H. Wordingham) addressed the Section on March 22nd, 1918, when he discussed Labour problems, and in particular the organisation of the engineering profession. As in the two previous sessions, the Council decided not to award any premiums for students' papers this year. No visits or social functions have been held during the session. The Scottish and Newcastle Students' Sections have held no meetings during the session, but the Manchester Students' Section has held four general meetings. The Committee reports a considerable increase in the attendances at the general meetings, which is probably due in part to the holding of the meetings at the various colleges, necessitated by the occupation of the Institution buildings.

Decimal Coinage.—Lord Southwark has fixed the second reading of the Decimal Coinage Bill in the House of Peers for Tuesday next. Lord Leverhulme has given notice of his intention to move the rejection of the measure.—*Daily Telegraph.*

Proposed Engineers' Club for the Midlands.—A representative meeting was held on May 15th, at the Chamber of Commerce, Birmingham, in connection with the project for forming an Engineers' Club in the Midlands.

In opening the proceedings, the chairman, Dr. C. C. Garrard, M.I.E.E., remarked that in the future a great responsibility would rest upon engineers and upon all occupying leading positions in the engineering industry in connection with the work of reconstruction rendered necessary by the war. It was felt, however, that as a body engineers had not the power corresponding to their abilities. This was no doubt due to their being so scattered and split up into a large number of organisations which had very little contact with each other. It was felt that the first thing to do to get over this state of affairs was for engineers and those associated with them technically to get together and to know each other. The result would inevitably be co-operative action, which would undoubtedly result not only in advantages to engineers themselves, but in great benefit to the country.

Guided by these considerations, the idea had arisen to found an Engineers' Club in the Midlands. A very successful Engineers' Club was in existence in Manchester, and that club had intimated its willingness to render all the assistance possible in the founding of a similar club in Birmingham. The enthusiasm with which the idea had been greeted by everybody concerned showed that such a club could undoubtedly be formed successfully. It should offer all the advantages of a first-class social club, combined with facilities for meetings, lectures, &c. It was hoped that it would become the meeting-place of the various technical societies in the district.

The present scheme was part of a larger idea whereby such Engineers' Clubs would be founded in all the large engineering centres in the country. These, it was hoped, would eventually become federated together, so that members would not only have the practical advantages of the use of the club-houses in their travels, but the club would form a centre of engineering activities in each locality.

After discussion the following resolution was carried unanimously :—

"That a Midland Engineers' Club be founded in Birmingham, and that those present constitute themselves into a Provisional General Committee for the production of a scheme for such, with power to add to their number."

A "Finance and General Arrangements" Committee and a "Rules and Propaganda" Committee were then formed ; Dr. C. C. Garrard, of the General Electric Co., Ltd., and Mr. J. Fearn, of the Birmingham Small Arms Co., Ltd., were elected provisional chairman and honorary secretary respectively. The latter invites gentlemen interested in this project to communicate with him.

We may point out that the formation of Engineers' Clubs is one of the items in Mr. Wordingham's programme, and that a similar project is being developed by the Newcastle Local Section of the Institution of Electrical Engineers, as reported in our last issue. The benefits to be derived from such institutions have been fully demonstrated by the remarkable success of the Manchester Club, and the movement should command the support of all engineers.

An Industrial "Safety First" Campaign.—In deference to a widely expressed desire for an Industrial "Safety First" campaign to apply to the whole of the United Kingdom, the London "Safety First" Council has taken the initiative by convening a conference, which will be held, under the patronage of the Lord Mayor, at the Mansion House, on June 12th, at 4 p.m. Lord Leverhulme, who will preside and speak on the subject of "Safety First" and its successful application at the Port Sunlight works, will be supported by personages influential in Government, Industrial and Labour circles.

The gratifying success which has attended the campaigns conducted by the London "Safety First" Council, by certain railway and transportation companies, and by industrial organisations in the country, has focused attention upon the incalculable benefits which would accrue from a general extension of the movement to the industrial community.

At no time in the history of the nation was the need for the conservation of human life more urgent, vital or opportune than at the present moment. The wastage caused by the most devastating war in the annals of the world has to be repaired. Innumerable industrial workers are concentrating upon supplying the needs of the men at the Front. Continuous work at high pressure has produced fatigue, and the resultant greater liability to accident. Accident prevention has, therefore, become, and will remain, an important factor in industrial and national progress, in that not only will thousands of valuable lives be saved, and untold human suffering be alleviated, but greater efficiency, increased production and economical working will be promoted to the mutual advantage of employer and employé.

The success of the American "Safety First" movement is irrefutable, and statistics show that industrial and transportation casualties have, in some instances, been reduced by nearly 50 per cent.

Applications for invitations to the Conference should at once be addressed to the Hon. Secretaries, London "Safety First" Council, 31, Westminster Broadway, S.W. 1.

Civil Engineers' Congress at Paris.—The Civil Engineers' General Congress was inaugurated on March 18th, when both the President of France and M. Clémental, Minister of Commerce and Industries, were present at the opening meeting held at the Sorbonne. M. Alexander Millerand, who presided over the work of the Congress, in his opening speech, emphasised the importance of the collaboration of science and industry, and the necessity of Capital and Labour working in harmony. The questions of apprenticeship and technical instruction were expounded by M. Léon Eyrolles, and amongst those who took part in the discussion were M. Kling, on reforms in the teaching of chemistry ; M. Léon Guillett, on the revision of the programmes of higher schools and the alleviation of the studies of higher mathematics ; and M. A. Rateau, on the formation of a higher institute of mechanics. Lieut.-Col. Renard then gave a *résumé* of the tendencies to which future technical instruction was leaning ; the union or bringing into intimate contact of doctrines and realities, *i.e.*, recruiting professors from the professions which they taught. The Congress closed on March 23rd, when M. Mainié, President of the Tenth Section (Industrial Legislation), in his speech gave a *résumé* of the work of the Congress, and paid a tribute to the Press reporters, whose collective publications covered not less than 3,000 pages ; the reports of the meetings included the full texts of all resolutions adopted. After going over the most important propositions made during the discussions, M. Mainié thanked the Society of Civil Engineers of France for its co-operation and assistance given to the Congress. He paid a tribute to the work of the organisers of the Congress, more particularly Messrs. Bodin and Barbet, to whom its success was largely due. The President, M. A. Millerand, then spoke of the praiseworthy work of the initiator of the Congress, M. Barbet, and all those who had contributed to its success. He recalled the promise, made at the inauguration, by M. Clémental, Minister of Commerce, that all resolutions adopted by the Congress would be referred to a Consultative Committee, composed of technical men and manufacturers, which would form a basis upon which to commence work. Further, a Permanent Commission, composed of the Board, Presidents of Sections, and general reporters, was to watch the progress made as a result of the work of the Congress ; and to remind the Minister from time to time that French industry anxiously awaited the reforms upon which its future depended.—*Le Genie Civil.*

Electro-metallurgy in France.—In the course of his presidential address to the Iron and Steel Institute, Mr. Eugène Schneider said that it behoved the French to cast up the account of their resources in hydraulic power, so as to reserve for metallurgical purposes the greatest possible part of their coal production. Those resources might even now be easily appropriated for the traction of trains and tram-cars, lighting purposes, and the distribution of power over extensive zones, since a 60,000-volt pressure was in use, and one of 120,000 volts would be so very soon. Whereas the waterfalls now utilised yielded only from 700,000 to 800,000 H.P., future plants should allow a yield, at low water, of a minimum of 4,500,000 H.P. And as 1,000 hydraulic H.P. economised per year 10,000 tons of coal, in round numbers, the saving to expect from those plants would rise to 30 million tons, a figure approximating to their total coal extraction before the war.

Hydro-electric power had the defect of being transmitted by very long lines exposed to many risks. It would, therefore, be well to provide very powerful thermal generating sets, ready for running at a moment's notice, and capable of carrying on the work in the chief departments, pending the time when the thermal emergency stations had brought up to a maximum figure their normal reduced power.

That part would devolve upon groups worked by Diesel motors of 2,000, 4,000, and even 6,000 H.P., the price of oil fuel being in that case a negligible matter. They were studying in France such motors, and their realisation seemed assured.

The electric blast furnace was not yet widely used in industry, but the development of electric furnaces destined to the production and refining of steel was certainly assured, especially in works using hydro-electric current as motive power. It was likely that various combinations of the electric furnace with the Thomas converter or basic open-hearth steel would in future be the characteristic feature of that special iron metallurgy which was the necessary consequence of a dual source of heat. It would be the topography of the region, or, more exactly, the position of the works on the "electric map" of France, that would determine the proportionate demand to be made from either of the two sources.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Hackney Council's Establishment and General Purposes Committee has reported making certain recommendations respecting a communication received from MR. L. L. ROBINSON, the borough electrical engineer, regarding his salary. It states that it cannot recommend the Council to agree to the suggestion of the borough electrical engineer that he should be paid a minimum fixed annual salary of £850, and £50 for each 1 per cent. gross profit earned on the capital expenditure of the undertaking, as such a proposition embraces in principle the question of a bonus scheme which has not yet been adopted by the Council, and which, if subsequently decided on, should be dealt with as a whole, and not by means of individual applications. It recommends that the salary of the engineer be increased as from April 1st, 1918, from £750 to £850 per annum, with increments of £50 per annum on each succeeding April 1st, to a maximum of £1,000 per annum, and that the amount of such annual salary be inclusive of any amount given as "war bonus," "war wage," or other grant now made, or which may subsequently be made, under any award or order or resolution of the Council.

Mr. F. Woods, station superintendent at the Rawtenstall Corporation electricity works, has been appointed, from 72 candidates, to the position of resident engineer to the Woking Electric Supply Co. He has been at Rawtenstall for three and-a-half years, before which he was at Prestwich with the Lancashire Power Co.

Mr. E. F. Joyce, resident engineer and works manager at the power station of the Woking Electric Supply Co., Ltd., is severing his connection with the company. He has recently been ill with rheumatic fever.

The *Morning Post* states that Lord Rhondda has asked the Leeds Corporation to release Mr. J. B. Hamilton, tramways manager, in order that he may take charge of a new department, to be called the General Storage and Inland Transport Department, which will co-ordinate the work of all existing branches of the Ministry of Food at present dealing with these questions. The Tramways Committee has complied with the request.

The Glasgow Tramways Committee propose the following increases to the salaries of the principal officials (the figures showing the present salaries and the recommended increases:—Mr. J. Dalrymple, general manager, £1,300—£200; Mr. L. Mackinnon, traffic superintendent, £700—£50; Mr. J. Ferguson, chief engineer, £700—£50; Mr. J. N. Wilson, secretary and treasurer, £525—£75; Mr. J. Grierson, civil engineer, £320—£20; Mr. G. B. Masterton, chief draughtsman, £310—£20; Mr. D. I. Liddell, outdoor traffic superintendent, £310—£20; Mr. F. W. Christall, claims superintendent, £380—£20.

The Bridlington Town Council has increased the salary of Mr. F. Ffrench, deputy electrical engineer, from £160 to £185 per annum.

Mr. P. T. Kimmins, the engineer to the Lynton and Lynmouth Electric Light Co., Ltd., has been co-opted by the Lynton Urban District Council as a Member of that Council.

General.—Prof. Sir James Dewar, F.R.S., has been awarded the Medal of the Society of Chemical Industry in recognition of conspicuous services rendered to the chemical industry by his research work in both pure and applied science.

The *Commonwealth Engineer* states that Mr. H. Percy Moss has been appointed electrical engineer to the Commonwealth Works and Railways Department. Mr. Moss is at present in Brisbane in connection with the acetate of lime plant being installed for the Defence Department.

The same contemporary records that Mr. H. J. Spencer, formerly of the Tasmanian Hyrdro-electric Department, has received an appointment with the Commonwealth Department of Works and Railways.

In recognition of his long public services, and as Mayor for two years and Deputy-Mayor for four, Alderman G. Weeks, of Weeks and Sons, electrical engineers, of Bromley (Kent), is to be presented with his portrait in oils.

Roll of Honour.—Private W. Fawcett, of the Cheshire Regiment, who has been killed in action, was an apprentice in the electrical department at Brookfoot Dye Works, Brighouse.

Private S. R. Ward, Machine Gun Corps, who is a prisoner of war in Germany, was on the clerical staff of Messrs. Dick, Kerr and Co., of Preston.

Private W. Boyd, South Lancashire Regiment, killed in action, was with the St. Helens Cable and Rubber Co., Ltd., Warrington.

Private T. Ellams, South Lancashire Regiment, killed in action, was with the B.I. and Helsby Cables, Ltd., Prescot.

Lance-Corporal A. Eastwood, Manchester Regiment, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Signaller H. A. V. Pease, London Regiment, killed in action, was prior to the war with Dick, Kerr & Co., Ltd., London.

The Military Medal for courage and initiative under hostile shell fire has been awarded to Rifleman C. R. Johnson, K.R.R., who enlisted from Siemens Bros. Dynamo Works, Stafford.

Wireless Operator Douglas M. Harris, of H.M. drifter *Floandi*, has been killed by a piece of shell whilst writing in the signal log of the ship in the Adriatic Sea.

Private J. Dean, Northumberland Fusiliers, who has died of wounds, was with Messrs. Taylor, Tunnicliffe & Co., Hanley.

Private Watson Bell, Liverpool Regiment, who has died of wounds, was an electrical engineer. He served his apprenticeship at Whitehaven with Messrs. Ramsay, and enlisted whilst engaged at Liverpool.

Quartermaster-Sergeant Harold Kerr, R.E., who enlisted from the staff of Joseph Walker & Sons, electricians, Whitehaven, has been killed in action.

E. H. Beesley, first-class air mechanic, R.N.A.S., and eldest son of Mr. Edward Beesley, electrical engineer, of Caledonian Road, N., for whom he was manager, has been awarded the D.S.M. for gallantry in connection with a bombing plane in flames.

Private W. Bunnage, Wilts. Regiment, formerly in the general office of the India-Rubber Co., Silvertown, is a prisoner of war. Gunner T. Ross, R.F.A., late of the cable department of the same company, died of wounds on May 1st.

Major Angus Macpherson, Machine Gun Corps, who prior to the outbreak of war was on the staff of the Glasgow Corporation tramways, has been awarded the Military Cross. Major Macpherson is 27 years of age, and has risen from a private in the original Expeditionary Force to his present rank. He has been wounded three times, received mention in dispatches on four occasions, and has been awarded the D.C.M.

Captain and Adjutant H. Smith, formerly on the staff of the traffic department of the Leeds Corporation Tramways, who was recently killed in action, has been awarded a bar to the Military Cross he already held.

Obituary.—Mr. J. B. Richards, assistant electrical engineer of the Postmaster-General's Department in South Australia, passed away suddenly in December last. The *Commonwealth Engineer* states that his connection with the Department extended over 37 years. During various periods he held the positions of postmaster, telegraph line overseer, controller of stores, inspector of telegraph lines, and assistant electrical engineer.

NEW COMPANIES REGISTERED.

British Engineering Standards Association (Word "limited" omitted from title by licence of the Board of Trade) (150,504).—Registered May 23rd as a company limited by guarantee (not formed for purpose of profit), with an unlimited number of members, each liable for £1 in the event of winding up, to co-ordinate the efforts of producers and users for improvement and standardisation of engineering materials, for this purpose to take over work which has been carried on since 1901 by the Engineering Standards Committee, to register in the name of the Association the mark which was originally registered for the said Committee in 1903, to prove and affix, or license the affixing of such mark or other proof, letter, or device to certain engineering materials, &c. The first Main Committee is to consist of such of the following as consent to act, viz.:—Sir John Wolfe Barry, K.C.B. (chairman), Sir Maurice Fitzmaurice, C.M.G. (vice-chairman), Sir Douglas Fox, Sir Wm. Matthews, K.C.M.G., H. Elliott-Cooper, A. Ross, and Dr. C. Unwin (nominated by the Institution of Civil Engineers); H. V. Ivatt, N. Longridge, and Dr. W. H. Maw (nominated by the Institution of Mechanical Engineers); G. Ainsworth, Dr. A. Cooper, and I. Williams (nominated by the Iron and Steel Institute); Sir Archibald Denny, Sir W. E. Smith, C.B., and Sir Thos. Bell, K.B.E. (nominated by the Institution of Naval Architects); Col. R. E. B. Crompton, C.B., Sir J. Snell, and C. P. Sparks (nominated by the Institution of Electrical Engineers); F. C. Gilbertson and F. R. Davenport (co-opted by the nominated members to represent the Federation of British Industries); the Hon. Sir Chas. Parsons, K.C.B., Sir Richard Glazebrook, C.B., and Sir Robert Hadfield, Bart. (co-opted by the nominated members). Hon. Secretary: J. H. T. Tudsbery, D.Sc. (Another clause says: The first secretary of the Main Committee and of the Association shall be C. le Maistre, Esq., A.M.Inst.C.E., M.I.E.E.) Every member is to have one vote. Solicitors: Hargrove & Co., 16, Victoria Street, S.W.

Magneto and Spare Part Co., Ltd. (150,486).—Private company. Registered May 21st. Capital, £1,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are:—G. Malham, Rothesay House, Beaufort Road, Edgbaston, Birmingham, engineer; S. H. Parrott, 227, Broad Street, Birmingham, magneto expert. The first directors are: G. Malham and S. H. Parrott. Registered office: 227, Broad Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Crompton & Co., Ltd.—Particulars of £150,000 debentures, created March 28th, 1918, and secured by trust deed dated May 1st, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Freehold and leasehold property, patents, and the company's undertaking and property, present and future, including uncalled capital. Trustees: I. Bevan and the Hon. Sir Charles A. Parsons, K.C.B. (Some of the debentures were issued in exchange for previously existing debentures.)

E. S. Co., Ltd.—Particulars of £6,000 first mortgage debentures created May 10th, 1918 (including £2,000 previously issued) have been filed, the amount of the present issue being £4,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. Payment of £2,000 debentures issued in 1915 has been postponed from 1922 to 1928, and the interest raised from 5 to 6 per cent.

Magnesium Metal Co., Ltd.—Mortgage debenture for £5,000, dated May 1st, 1918, charged on the company's undertaking and property, present and future, including uncalled capital (subject to charge securing £10,000 advanced by Vickers, Ltd.). Holders: Johnson, Matthey and Co., 78, Hatton Garden, E.C.

Reform Lighting Corporation, Ltd.—Memorandum of satisfaction to the extent of £1,850 on May 10th, 1918, of debenture [illegible] March 26th, 1913, securing £2,750, has been filed.

Kingolite Co., Ltd.—Issue on May 1st, 1918, of £400 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett, presiding at the annual meeting on May 8th, said that they were asking sanction for a further increase in borrowing powers to enable them to take advantage of the loan which the Government was prepared to make. The profits for the year were larger by £2,750. The net balance was £950 better than in the previous year. It was unsatisfactory to leave the preference dividend one year in arrear, but it was as satisfactory as they could expect under existing conditions. They must conserve their somewhat slender cash resources. They had connected an additional 3,016 KW. during the year—rather less than their record connection of the previous year; 92 per cent. of the new connections were for power and heating. The output for the year increased by nearly 2½ million units; coal cost £7,000 more owing to an average increase of 2s. per ton, and much of it was of inferior quality. Wages and salaries increased by nearly £5,000. The progress made by the Twickenham and Cornwall undertakings was particularly gratifying, the latter having increased its profits by over £6,000, and the former by over £4,500, but instead of paying larger dividends these companies had substantially strengthened their reserves. The conditions of operating were abnormal, and the outlook was very disquieting in consequence of the various awards and the restrictive regulations. No one could forecast the extent or outcome of these developments, but as far as possible they were taking steps to minimise them. They had applied to the Board of Trade, where they were in a position to do so, requesting them to sanction increased maximum rates. But for the war they would now have been paying an ordinary dividend, or would at least have been within sight of its early payment. The new agreement with Edmundsons followed the lines of the previous agreement, except that the annual payment for management and administration was increased from £2,000 to £3,000. The output was now over 31 million units, and the revenue close upon a quarter of a million, and the fact that the business consisted of a number of small undertakings scattered all over the country involved a great deal more detail and supervision than would be the case if it were concentrated in a single undertaking. Edmundsons' association with the company was an undoubted source of strength, and without the financial assistance which they had afforded them it would have been impossible for them to have made the progress that they had made.

Anglo-Portuguese Telephone Co., Ltd. The report for 1917 submitted to the annual meeting on May 22nd showed a profit of £25,617, against £31,599, and after paying income-tax, debenture interest, and sinking fund, putting £10,000 to renewals, 6 per cent. dividend is to be paid for the year, carrying forward £7,093. The profit was adversely affected by a further fall in the exchange value of the Portuguese currency, the actual loss on remittances amounting approximately to £22,000, an increase of £6,000. Mr. Herbert Allen, who presided at the meeting, said that owing to their inability to obtain the necessary equipment either from this country or from the U.S.A., they had installed fewer new subscribers than for many years. There were hundreds of new customers waiting. For 34¾ million calls handled, the cost worked out at about ½d. per message, average. They had had a strike of workmen in Portugal, as they were not prepared to concede a 50 per cent. advance for which the men asked. As usual, the Government intervened, and they had to make substantial concessions, but they were permitted to increase their tariff by 15 per cent. on condition that the Government took the difference if that increase more than sufficed to meet the increased wages cost. The continued rise in the rate of exchange had hit them hardest of all. They had applied for authority to further advance their tariff to meet the increased cost of working. There was scope for endless capital expenditure with, under reasonable conditions, a prospect of a fair return, but unless they could maintain their dividend it would be impossible to raise new capital for their ever-growing business. The commercial life of Portugal was looking more settled, and this and other influences might have a steadying effect on the exchange.

London and Suburban Traction Co., Ltd. The report for 1917 records a substantial reduction in the return upon the company's investments. The net revenues of the tramway and omnibus companies have in nearly every case been adversely affected by the continuance of the war, increase in tramway receipts as a whole being more than balanced by the increased expenses of operation due to the further rise in the cost of labour and all materials, while the shortage of petrol and increased working charges have resulted in a large decrease in the net receipts of the omnibus undertakings. The revenue, consisting almost entirely of dividends and interest receivable from the subsidiary companies, amounted to £81,519, a reduction of £39,067 as against 1916. After paying debenture and loan charges, 2½ per cent for the year is paid on the preference shares, and £3,635 is carried forward. The report refers to the measures taken for reorganising the capital of the London United Tramways, Ltd., subject to a Bill passing. Under the terms of the scheme, funds will be forthcoming for reconstruction of permanent way and renewal of rolling stock and other equipment.

Electric Construction Co., Ltd. The annual meeting, on Wednesday, was presided over by Mr. P. E. Beachcroft, who said that when presiding last year he thought the company had reached high-water mark under existing conditions, but he was pleased to say that, notwithstanding the difficulties which were foreseen and encountered, they had again considerably increased the turnover, and showed a substantial increase in net profit. The gross profit for 1917-18 amounted to £112,600, as against £103,000 in 1916-17, an increase of £9,600, and the net profit had increased by £15,300—from £51,500 to £66,800. After referring to the disposal of the profit as in the report, the chairman said that they had continued their policy of purchasing the company's debentures when a favourable opportunity offered, and during the past year they procured £2,310, the discount whereon, amounting to £674, was added to general reserve fund as usual. That fund at March 31st amounted to £63,174, and with the contribution out of profits now recommended would stand at £72,500. This was invested to a very large extent in Government and trustee securities and in short-dated debentures, all of which would be available for the purposes of the company as and when required. In addition, they had ample working capital, and altogether the financial position of the company was as strong as they could wish. He would particularly emphasise the fact that they had year by year provided considerable sums for new plant and tools, which should, after this disastrous war was over and done with, place them in such a strong position as to costs of production as would enable them to meet any competition which might arise. They would expect him to say something, as usual, regarding the prospects and general condition of affairs. Well, he was a great believer in the precept, "Do not prophesy unless you know," but he was well within the mark when he said that the immediate prospects were quite encouraging, as they had commenced the new financial year under auspices more promising than heretofore, and, assuming that the supply of materials was maintained in a reasonable manner, the results should prove satisfactory. The irregular supply of materials had been one of their greatest difficulties, and they would realise its effects on the prompt delivery of their machines, and on the cost of production. The relation of Capital and Labour after the war had been engaging the attention of various commissions and committees, and many suggestions had been made of an interesting and far-reaching character. To enable the country to recover from the financial strain of the war a larger output per head would be essential, and if, in exchange for the removal of restrictions relating to output, workpeople secured a larger share of the proceeds of Capital and Labour, the result would be for the general good. They were members of the Federation of British Industries, which was taking an active part in these matters, and any measures framed to this end would have their sympathy and support. Meantime, it afforded him much pleasure to say that the relations with their own workpeople continued to be of the most harmonious character. Although Sunday labour was discontinued by the Ministry of Munitions of War in the beginning of their last financial year, their turnover, with only a comparatively small addition to their tool equipment, showed an increase, and this had been the experience of others. There could, therefore, be no question that this was a wise step on the part of the Ministry, as the strain of continuous employment was more than could be borne reasonably. Even to maintain their turnover very special efforts were necessary on the part of both the staff and workpeople, and they tendered them their best thanks from the manager downwards. Their attention no doubt was directed a short time ago to a somewhat phenomenal rise in the market value of the shares. There had been many rumours prevailing of amalgamations, or reciprocal trading relationships between companies having kindred businesses, and he could only suppose that there was some such rumour with regard to this company. No arrangement of this kind, however, had been under consideration. The whole attention of the board and management was devoted to the advancement of the company's interests without regard to the fluctuations of the market value of the shares. Many of them had held the bulk of their shares from the early years, and had endured with patience and confidence the days of stress and troubles, but they were now reaping a well-earned return—due to the strenuous labour on the part of their active management during those times, as well as the present.

Mr. James Gray seconded the motion, and the report was adopted.

General Electric Co. (U.S.A.) The report for 1917 shows that the value of orders received for the past five years has been as follows:—

	Electrical and mechanical.	War munitions.	Total.
1917	$246,778,491	—	$246,778,491
1916	167,169,058	$2,416,000	169,585,058
1915	98,385,891	33,980,000	132,365,891
1914	83,748,521	—	83,748,521
1913	111,819,142	—	111,819,142

A substantial portion of the large increase for the past year consisted of orders for ship propulsion and other apparatus placed by and for the United States Government, but the increase extended to nearly every line of the company's product. Higher prices, due to increased cost of materials and labour, were also a factor in the larger total value of orders. The amount of sales billed was $196,926,318, an increase of $62,684,028, or 47 per cent. over the previous year. The net result was a profit of $29,004,540, plus income from other sources $4,512,290, less interest on debentures $571,645, interest and discount on notes payable $541,357, leaving available for excess profits tax and dividends $32,403,828. Excess profits tax estimated $5,500,000, dividends $11,165,882, leaving a surplus for the year of $15,737,946. The large increase in sales during the last two years has made it necessary to add to manufacturing facilities to an extent entirely without precedent. During the year $22,320,895 was expended for land, buildings and other structures, tools, machinery and smaller equipment and fixtures. In view of the prevailing high prices of all material and other unusual conditions, the sum of $13,287,249 has been charged against income and general reserve as depreciation and additional plant reserves, resulting in a net increase, in the book value of plant and equipment, of $9,033,646. In addition to the $22,320,895.06 expended last year, it has been necessary to authorise expenditures for further plant extensions amounting to $13,000,000, which will be completed during 1918. The total factory floor space in recent years has been as follows:—

1915	14,830,000 sq. ft.
1916	15,300,000 sq. ft.
1917	17,573,000 sq. ft.

At a special meeting of the stockholders held in January, 1918, it was voted to increase the authorised capital stock of the company from $105,000,000 to $125,000,000. The new stock has since been offered to the stockholders, and all subscribed. The dividends declared by the directors for the year 1917 were, therefore:—Cash dividends, 8 per cent., $8,120,648; "Red Cross" dividend, 1 per cent. cash, $1,015,078; initial stock dividend, at 4 per cent. per annum, $2,030,156; total, $11,165,882.

German Companies.

The directors of the *Welter, Elektrizitats und Hebezeug Werke A.G. of Cologne-Zollstock* recommend a dividend at the rate of 8 per cent. for 1917, as contrasted with 6 per cent. in the previous year.

The Korting und Mathiesen A.G., of Leutsch, Leipsig (arc lamps and electrical apparatus), proposes to raise the rate of distribution from 8 per cent. in 1916 to 16 per cent. for last year.

The Dr. Paul Meyer A.G., of Berlin, reports an allocation of £8,000 to depreciation in 1917, this comparing with £13,000 in the previous 12 months. It is intended to pay a dividend at the rate of 10 per cent. out of net profits of £24,000, as contrasted with 7½ per cent. and £19,000 respectively in the preceding year.

The accounts of the *Land und Seekabel Werke A.G., of Cologne-Nippes,* show the appropriation of £19,000 for depreciation in 1917, as compared with £7,000 in the previous year. The net profits were £37,000, as in 1916, and the dividend is again at the rate of 12 per cent. on the paid-up capital of £262,000.

The Felten & Guilleaume Carlswerk A.G., of Cologne-Mulheim, after setting aside £243,000 for depreciation in 1917, as against £156,000 in the preceding year, reports net profits of £519,000 and £418,000 in the two years respectively. It is proposed to increase the rate of distribution from the 12 per cent. paid for 1916 to 15 per cent. for the past year.

The Elektrizitats Lieferungs Gesellschaft, of Berlin, which owns a number of supply works and is interested in various others, and also in tramways, states that as a consequence of a friendly understanding with most consumers in regard to price increases, the working results in 1917 were not affected by the greater cost of raw materials and the limitation in the consumption. After placing £52,000 to depreciation, as contrasted with £27,000 in 1916, the accounts indicate net profits of £163,000, being the same as in the preceding year. The dividend is at the rate of 10 per cent. on the ordinary share capital of £1,500,000, as in each of the three previous years.

The Hamburg Hochbahn A.G., of Hamburg, records an increase in the gross revenue in 1917, and net profits of £47,000, as against £32,000 in 1916. The directors recommend a dividend at the rate of 5½ per cent., as compared with 4 per cent. in the preceding year. At the instance of the Hamburg State this elevated railway company is to be converted into a joint economic undertaking, in which the State will have a preponderating influence in the carrying out of the city high-speed railway, the tramway and motor omnibus traffic, as well as of shipping on the Alster.

The French Thomson-Houston Co.

The report of the directors of the Compagnie Francaise Thomson-Houston states that the activity of all departments was maintained in 1917, and the total value of the turnover was greater than in any preceding year. At the same time, the production, reckoned according to the number of machines and in kilowatts, was higher than in peace time, thus indicating that the normal manufactures continued to develop, notwithstanding the company's output of war material and the difficulties experienced in obtaining supplies of raw materials and of labour. The extensions and increases in plant and equipment were continued, and the erection of the new shops at the telephone factory was in an advanced stage. All the sites owned by the company were being utilised to the fullest extent, and other sites had to be rented for the execution of war contracts. On the other hand, it was now known from a reliable source that the Lesquin works, near Lille, had been entirely dismantled and demolished by the enemy. Under these circumstances, the directors had considered it indispensable already now to procure sites which would be needed to deal with the industrial development which was foreseen in the near future, and lands had, therefore, been acquired for this purpose of a superficial area of about 75 acres, bordering on the railway and the Seine.

The turnover in the department devoted to telegraphy, telephony, and apparatus for railways exceeded by 70 per cent. that which prevailed in 1916, the development having been limited solely by the productive capacity. The directors were increasingly convinced that in this special branch, both in regard to public and private telephony, they had a large sphere of activity, and that the business would be considerably increased when further productive means were available. The sale of batteries was becoming an important branch, and the small "Mazda" battery was as successful with customers as the lamp of the same name. The construction of large batteries for the postal service had been developed, and there was about to be added the production of types of batteries for water or electrolyte filling of greater duration. Discussing the satisfactory course of the lamp department, the report states that the present relatively high prices had caused foreign lamps to be imported, and schemes to be promoted for the erection of new lamp factories, which, however, were not necessary to meet the requirements of the market. Several months ago the first turbo set of 6,000 KW. for the Compagnie Générale de Distribution d'Energie was set in operation, and, owing to the expansion of the industrial needs in that company's area, it had been decided to transfer to the station a second set of the same power from a provincial station, whilst a third set of 10,000 KW., which was originally intended for the Baku Co., was in course of erection. The first sections of the plant for the Usine d'Eget of the Compagnie du Midi, comprising seven alternators of 4,375 KW., transformers from 120,000 volts, switchboards, &c., had already been forwarded from America, and the remainder was being completed. After referring to new orders on hand, including contracts for turbo-alternators of 6,000 KW., transformers of 5,000 KW., frequency transformers, tractors or petrol-electric locomotives, &c., the report mentions that the sale of standard plant continues to expand, particularly in regard to machines for generating sets, high-speed motors for pumps and ventilators, lifting plant, &c. In conclusion, reference is made in detail to the supply works and tramways in which the company holds a financial interest.

The accounts show gross profit for 1917 amounting to £455,000, as compared with £423,000 in the preceding year. After defraying general expenses, financial charges, and placing £78,000 to depreciation, the net profits are returned at £200,000, as against £173,000 in the previous year. The dividend is at the rate of 8 per cent. on the ordinary share capital of £2,400,000, this contrasting with 7 per cent. in 1916.

Shanghai Electric Construction Co., Ltd.—Supplementing our note of last week, in which we announced the dividends for the year, we observe from the report now to hand that the profit was £67,504 against £48,123 for 1916. The loss by exchange on subsidiary coinage in 1917 was £35,478, which is equal to 11.09 per cent. on the capital of the company. The ratio of depreciation to gross takings was sensibly lower during the past year than for several years past. The traffics and net receipts for the current year continue to be satisfactory. An arrangement made with the Municipal Council to commute the company's liability for road maintenance by payment of an annual sum of Tls. 16,500, subject to revision every ten years, was confirmed at the annual meeting of ratepayers, held in March last. The construction of the new central offices in Shanghai is proceeding satisfactorily, and it is expected that the building will be ready for occupation this year.

West India and Panama Telegraph Co., Ltd.—The amount to credit of revenue for 1917 is £113,644, and the expenses have been £69,344, leaving £44,300, plus £3,205 from interest on investments, and £2,888 brought forward. From this sum there has been deducted £6,065, the cost of extending the date of maturity of the debentures, leaving £44,328. The directors have placed to general reserve £10,000, and they propose a final dividend on ordinary shares of 6d. per share, and a bonus of 3d. per share, both free of income-tax, carrying forward £5,268. The traffic receipts show an increase over those for 1916. The receipts for the current year so far show a slight falling off as compared with those for 1917. It is not possible under present circumstances to set aside a special reserve to meet depreciation on investments in respect of reserve funds.

Brush Electrical Engineering Co., Ltd.—Dividend of 6 per cent. on the ordinary stock for each of the years 1916 and 1917.

Companies to be Struck Off.—The following companies are to be struck off the register within three months, unless cause is shown to the contrary:—

Argentine Electrolytic Syndicate, Ltd.
Armour Plate (Cowper-Coles Patents), Ltd.
Bachelet Levitated Railway, Ltd.
Colonial Rail & Tramway Syndicate, Ltd.
Crowther & Co.'s Electrical Industries, Ltd.
Davis Electrical Co., Ltd.
Electromobile Co., Ltd.
Ideal Publicity Co., Ltd.
J. G. Childs & Co., Ltd.
Measures Bros., Ltd. (1899).
Mechanical Traction Syndicate, Ltd
Miners' Lamp Electric Lighting Co., Ltd.
Rossendale Belting Co., Ltd. (1908).
Salt Lake and Ogden Gas & Electric Light Co., Ltd.
Spiral Regulating Dynamo Co., Ltd.

Simplex Conduits, Ltd.—According to a financial contemporary, the accounts for 1917 show a net profit of £21,949 (against £8,639); £7,372 was brought forward, making £29,321. The directors announce a dividend of 10 per cent. and a bonus of 10 per cent., both free of tax, the same as last year; £2,000 to reserve (making £30,000), leaving £17,071 to be carried forward, subject to excess profits duty.

South Wales Electrical Power Distribution Co.—The report states that the business shows an increase during 1917, the units sold amounting to 36,959,049, an increase of 6,900,588 units, or nearly 23 per cent. Negotiations have been completed for a further substantial increase of output. After payment of all expenses the credit balance was £24,718. Deducting interest on prior lien debenture stock and the original debenture stock, and making provision for depreciation of the new plant, there is a balance of £64 to carry forward.

British Electric Traction Co., Ltd. Dividend of 6 per cent. on the cum. participating preference stock, and one of 3 per cent. on the ordinary. £20,000 to reserve.

Mirrlees, Bickerton & Day, Ltd. Dividend of 10 per cent., free of tax, on the ordinary shares. £5,000 to reserve, and £2,120 carried forward.

Anderston Foundry Co., Ltd.—Final dividend 17s. 6d. per share (making 22s.), less tax. £5,000 to reserve, carrying forward £13,225.

Provincial Tramways Co., Ltd.—Interim dividend 8d. per share, less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

Notwithstanding the commencement of the new German offensive, business in the Stock Exchange shows little contraction in volume. The principal market so far as activity is concerned continues to be that in which industrials are negotiated, and amongst these the shares of the manufacturing issues, more particularly electrical and cable, stand out with especial strength. The tone throughout the House as a whole is firm, the rise in the War Loan encouraging appreciation in the debenture stocks and preference shares of the best commercial undertakings; at the same time affording eloquent evidence of the calmness with which the public throughout the country regard the issue of the German advance.

Most of the shares in the cable market are better. Marked interest is once more directed to such companies as those which are in the habit of declaring their dividends free of income-tax. Advances have taken place in Eastern Extensions, Eastern and Western Telegraphs, Globe Ordinary, and various others. The jobbers lament that if only they could induce more sellers to realise holdings, there would be a big business doing, whereas the present condition is such that prices mount steadily, and yet no stock comes in to supply the people who are willing to pay the higher quotations, without, however, being able to get the stock. Henley's are noticeably strong, and a peculiarity of their market is the way in which small lots of shares are constantly being inquired for. The inference is that members of the staff are eager to place their savings in their company's shares, in addition to which it may be that in these, as in other similar cases, the shares are bought for the purpose of the companies' employés funds. General Electrics are another hard market; the ordinary are wanted at 20¼ or better.

The strength of other electrical manufacturing shares is thoroughly well maintained. Edisons, Electric Constructions, and British Aluminium are amongst those for which there is a constant demand, and British Westinghouse preference are steadily rallying after their slump, the price having improved to 46s. upwards. Other industrials show improvement in the majority of cases. The only section of the industrial market which is weak is that devoted to rubber shares, where the dividend outlook, combined with the unfortunate position into which the industry has fallen by reason of transport difficulties, &c., are causing people to realise their shares. The root of the trouble lies probably in the fact that, with Germany no longer able to get the rubber, the mid-East companies are producing too much, and the supply has overshot the demand.

The railway market is another of those in which recovery in share values is noticeable. Undergrounds are beginning to participate in the greater firmness shown during the past fortnight. Districts have recovered to 14½, and, although Metropolitan Consolidated has not moved, the tendency of the market in the stock is better. Underground Electric Income bonds lost part of their recent rise, but the company's shares, and those of the London Electric, are very steady.

The market for home electricity shares is steady. They continue to attract little interest, and there are few transactions taking place in them from day to day. The market, however, is firm, no shares coming in.

British Electric Traction has declared a dividend at the rate of 3 per cent. on the ordinary stock, the same as last year, placing about £20,000 to reserve. The price of the ordinary and 6 per cent. participating preference stocks now stand at 31½ and 73½ respectively. The last business recorded in the 5 per cent. debentures was at 77¾, while the 4½ per cent. second debenture changed hands at 63¼ a fortnight ago.

The strength of British Columbia stocks is well maintained, and the preferred has risen another point to 42½. Anglo-Argentine Tramways 5 per cent. debenture stock continues to improve, and is now 65. Mexicans show no quotable change. There are rumours of rupture between Mexico and Cuba, but these have not affected the railway stocks of the country, which are still on the up-gradé, though the Utilities have hardly moved. Mexico Tramways Common shares stand at 24½. Para Electric Railway Ordinary have improved to £4. Something of a feature during the past few days has been marked activity in Pernambuco Power Ordinary shares, which have risen from their recent lowest price of 6s. to the present price of 8s. 6d., the 7 per cent. preference going to 14s., and the 5 per cent. debentures to 67. No dividends are at present paid on the first two classes. Potteries Electric Ordinary changed hands this week at 7s. 4½d., and the 5 per cent. preference were last done at 12s. 6d. A transaction took place in the 4 per cent. debenture stock of the London United Tramways at 35¼ early in this week.

The British Insulated & Helsby Cables, Ltd., held a meeting at Liverpool on Monday, when a resolution was unanimously passed enabling the board to capitalise undivided profits and to distribute them among shareholders in the form of ordinary shares. The price of the latter at 75s. has gained ⅛ in consequence. Babcock & Wilcox advanced 1/16, and the armament group keeps very hard.

SHARE LIST OF ELECTRICAL COMPANIES

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price May 28, 1918.	Rise or fall this week.	Yield p.c
Brompton Ordinary	9	10	6⅞	—	£7 8 0
Charing Cross Ordinary ..	5	4	8¼	—	6 3 1
do. do. do. 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	3	5	8	—	8 6 8
City of London	8	8	12	—	6 10 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	—	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	6⅜	—	6 10 3
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 13 10
Metropolitan	8	4	3⅛	—	6 8 1
do. 4½ per cent. Pref.	4½	4½	3⅜	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1915.	Dividend 1916.			
Anglo-Am. Tel. Pref.	6	6	94	—	6 7 8
do. Def.	33/6	1½	22	—	6 14 10
Chile Telephone	8	8	7¾	—	5 3 3
Cuba Sub. Ord.	6	7	9½	—	*7 7 4
Eastern Extension	8	8	15⅜	+ ⅛	*5 4 0
Eastern Tel. Ord.	8	8	155½	+1	*5 3 0
Globe Tel. and T. Ord.	7	7	14⅝	+ ⅛	*4 15 9
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	22	24	38	+10/-	6 6 4
Indo-European	18	18	48½	—	6 14 0
Marconi	10	15	8⅛	—	4 17 10
Oriental Telephone Ord. ..	10	10	4 3/16	— 1/16	2 7 9
United R. Plate Tel.	8	8	7	—	*5 15 4
West India and Pan.	6d.	6d.	1½	—	*3 6 8
Western Telegraph	7	8	15⅝	+ ⅛	*5 2 5

Home Rails.

Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	20¾	—	4 16 5
do. District	Nil	Nil	14½	+ ¾	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	4/6	—	Nil
do. do. Income	6	4	76½	— ½	*5 4 7

Foreign Trams, &c.

	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	2 13/16	—	—
do. 2nd Pref. ..	5½	—	2½	—	—
do. 5 Deb. ..	5	5	65	+1	7 13 10
Brazil Tractions	4	4	48	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	60½	—	8 5 4
do. do. Preferred	Nil	Nil	42½	+1	Nil
do. do. Deferred	Nil	Nil	34	—	Nil
do. do. Deb.	4½	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	17½	—	Nil
do. Pref.	Nil	Nil	26½	—	Nil
do. 1st Bonds ..	Nil	Nil	38½	—	—

Manufacturing Companies.

Babcock & Wilcox	15	15	8 7/16	+ 1/16	4 7 8
British Aluminium Ord. ..	7	10	1⅝	+ 1/32	6 3 0
British Insulated Ord.	17½	20	3¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 5/16	+ ⅛	6 9 4
Callenders	20	20	17	—	5 17 8
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	22	20	3 13/32	—	5 17 4
Edison Swan, fully paid ..	—	—	2¼	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	7½	1 3/16	—	7 12 4
Gen. Elec. Pref.	6	6	10⅜	—	5 15 8
do. Ord.	10	10	20¼	—	4 18 9
Henley	25	25	20½	+ ½	6 2 0
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	15⅝	—	*6 8 0
Telegraph Con.	20	20	42½	+ ½	*5 18 0

* Dividends paid free of income-tax.

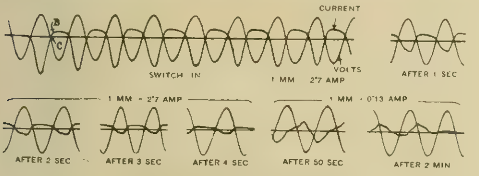
SOME TRANSIENT PHENOMENA IN ELECTRICAL SUPPLY SYSTEMS.

By PROF. E. W. MARCHANT, D.Sc., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE study of transient phenomena in electrical supply systems has become, with the increasing size of power stations and distributing networks, a subject of growing practical importance to electrical engineers. Nearly all the phenomena described in this paper have been observed by means of the oscillograph, and a considerable portion of the work involved in its preparation has been directed to enable them to be studied under known conditions, and to make them demonstrable and obvious with machines of moderate capacity.

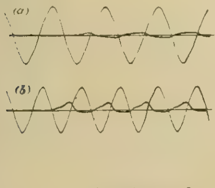
One of the best-known transient phenomena is that which occurs when a transformer is switched on to an A.C. supply system. When 100 periods was the standard frequency the phenomenon was usually of no great importance, since in such transformers the flux density in the core was usually kept low in order to avoid overheating; with 50-period transformers also, the phenomenon does not give rise to any very dangerous rushes, but with 25-period transformers worked at flux densities well over half saturation, the current which may flow when the transformer is switched in may be enormous. In fig. 1 is shown a current-rush observed on one phase of a 100-KW., 3-phase, 6,600-volt transformer of the core type, when switched on near the zero point of the pressure wave.



Current 90 deg. out of correct phase.

FIG. 1.

The rush depends not only on the point of the pressure wave at which the circuit is closed, but also on the remanent magnetism in the iron. For example, if the remanent magnetism is + 5,000 lines per square centimetre (see fig. 2) the working maximum flux density is ± 10,000, and the instant of closing circuit is O (see fig. 2), when under steady conditions the flux density should be − 10,000, there will be a flux density at the end of a half-period of 25,000 lines per square centimetre; the change in the flux density through the iron in order to provide the necessary counter E.M.F. being 20,000 (*i.e.*, from − 10,000 to + 10,000 under steady conditions), while, in addition, there is the initial remanent magnetism (O A) of 5,000. Under such circumstances the current flowing to the transformer will have to be sufficient to produce this flux density, and may be many hundred times the normal magnetising current. When the transformer is switched in at the same point of the pressure wave, but with no remanent magnetism, the current rush may also be a large one.



Current reversed.

FIG. 3.

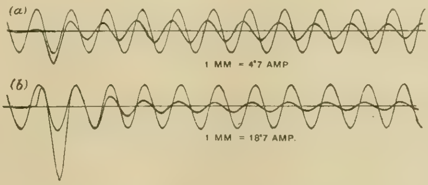
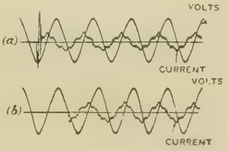


FIG. 4.



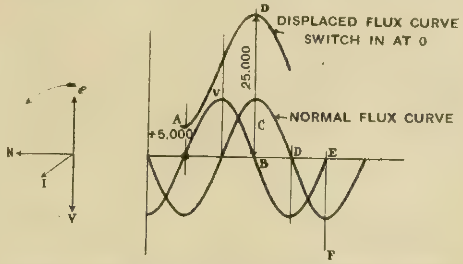
R.M.S. volts = 200.

FIG. 5.

A number of tests were made on a bank of three 100-KW. step-down transformers switched on to the mains. One of the records has been reproduced in fig. 1. Denoting the three phases by X, Y, and Z, the pressure has been measured across phases X and Z and the current in line Y, so that the current curve is 90 deg. out of its correct phase. The maximum value of the current-rush is over 90 times the steady magnetising current shown after two minutes. In this case the switch-in occurred very near the zero point on the pressure wave, *i.e.*, at the instant at which under steady working conditions the flux density should have a positive or negative maximum. Allowing for phase displacement of the current curve the pressure is decreasing (B, fig. 2), and the flux should have been a positive maximum. Assuming, in the first instance, that there is no remanent magnetism in the core, it follows that at the end of a quarter-period, when the "steady condition flux" would have been zero, the flux will now be − N (if N is the maximum value of the flux through the core); it is necessary, therefore, that there shall be a negative current. During the first quarter-period the current will not be very large. During the second quarter-period after switching-in, the negative flux through the core must continue to increase in order to provide a counter E.M.F. in the right direction, and at the end of the half-period it will have increased to a maximum value of nearly − 2 N (neglecting the effects of hysteresis and the resistance of the coils). The current required to produce this negative flux should also reach a maximum value at the same instant.

Had there actually been no remanent magnetism the current should have continued to remain negative during the third and fourth quarter-periods, but in the curves shown in fig. 1 the current reverses very soon after the maximum point on the pressure wave, so that there must have been a considerable positive remanent magnetisation of the core at the instant of switching-in, *i.e.*, conditions were not as bad as they might have been.

During the third quarter-period after switching-in, therefore, the flux changes from negative to positive, and the current required to produce it does the same, but, since the positive flux is comparatively small, the current required to produce it is small also, and the positive current during this and the fourth quarter-period is relatively small. The iron in this state being in a condition in which it has a very high permeability, it follows that a comparatively small increase in current is required to produce the necessary change of flux through the core. The curve of current is almost square, and the value of the current up to the bend represents the magnetising force necessary to reverse the direction of magnetisation of the iron, the subsequent alteration of flux being effected by a very small change in the current. The part of the curve marked C B is therefore a measure of the coercive force for the iron required to reduce the magnetism to zero. This coercive force increases during the first 10 or 12 periods, due presumably to the repeated powerful negative magnetisation of the iron.



N = flux; e = counter E.M.F.; V = applied potential difference; I = current.

FIG. 2.—VECTOR DIAGRAM.

The chief effect of the additional loss due to eddy currents will be to introduce a component into the current curve in phase with the voltage, this bringing the resultant current-wave more closely into phase with the voltage than the flux curve. This is shown in fig. 1, and the eddy-current component is clearly considerable. It is interesting to notice how slowly this remanent magnetism dies away. At the end of 50 seconds it is strong, and even after two minutes it is appreciable. This result is in accordance with the well-known fact that in order to destroy remanent magnetism it is necessary to demagnetise the iron by a magnetising force continuously reversed and considerably stronger than that which produced the original magnetisation. With the currents used the magnetising forces are not powerful enough to effect the demagnetisation of the iron rapidly. It has sometimes been noticed after switching-in transformers that the pronounced hum which always accompanies excessive magnetisation may last for as long as half an hour. During this time the heating of the core due to eddy currents and hysteresis is considerably greater than it is under steady conditions, and under some circumstances this may give rise to trouble in operating the transformer.

The factors affecting the current-rush are: (1) the condition of magnetisation of the core at the instant of "switching in," and (2) the instant of closing the circuit. It is therefore impossible to control the "rush" unless the transformer is switched out of circuit at a predetermined point on the pressure wave, so as to leave a definite remanent magnetism in the core, and is then switched in again at another predetermined instant.

In fig. 5 are shown curves obtained for the switching-in of two small transformers, in which the instant of closing circuit was controlled to within 1/1,000th of a second by a switch operated by a contact-maker on the alternator supplying the system. Similar results have been given by Prof. J. T. Morris for a circuit in which the connections were closed and opened in rapid succession.

Experiments were first made with a pair of 3-kw. transformers designed for a flux density of 3,000 lines per square centimetre at 100 volts and 100 periods. This transformer was connected to a 100-volt, 50-period circuit, so that the flux density in the core would be about 6,000 lines per square centimetre.

Two typical curves are shown in fig. 3 in which (a) the circuit is closed at the maximum point in the pressure curve, and the other (b) when it is closed at the zero point. In fig. 3 (b) the effects are the same as those already discussed, but the conditions become steady more rapidly on account of the smaller size of the transformers. With these transformers when the circuit is closed near the maximum point of the pressure wave the rush is negligible (fig. 3, a)—the actual instant of the switch-in was about 0.6 of the half wave from the zero point—and the current at once reached its steady value, and did not vary appreciably during the first few seconds, the curve being quite symmetrical.

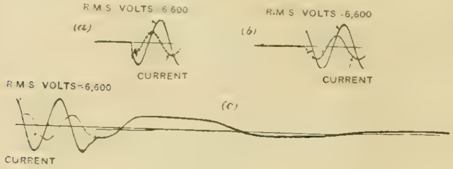


Fig. 6.

A current-rush nearly always occurs when an induction motor is switched on to a circuit. This curve, however, is somewhat different from that of the transformer, since the rotor circuit is closed so that the machine is similar to a short-circuited transformer, whereas in the case already considered the transformer secondary circuit is open. A number of induction motor-generators are in use on the Liverpool Corporation electric supply system, and some tests were made on one of 300 h.p. coupled to a continuous-current generator of 220-kw. output. The motor was three-phase, star-wound, with 6,000 volts between the lines, and taking a current at full load of 26 amperes per phase; the frequency was 50 periods, and the speed 420 r.p.m.

No attempt has been made to control the instant of closing the circuit, and in this case it will not greatly affect the rush of current. The records show that the rush is extremely large. In these tests it reached a maximum value of over 380 amperes per phase, or nearly 270 amperes r.m.s., *i.e.*, 10 times the full-load current. It is easy to see why this rush is a big one. When the machine is being run up on the continuous-current side, and before the high-tension switch on the induction motor is closed, there is no magnetisation in the stator core of the induction motor. If the machine were running absolutely synchronously the conditions would be similar to those existing when a transformer is switched on, and there might be a rush due to the same causes as those discussed above.

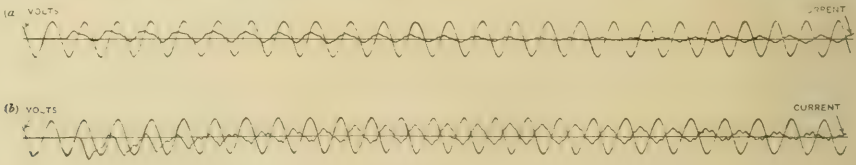


Fig. 8.

This rush will, however, be relatively small, since the flux density in the iron circuit of induction motors is low, and there is an air-gap in the iron circuit. Even under the most unfavourable conditions it is not comparable with that found in a stationary transformer.

It is, however, difficult to synchronise these machines exactly; ordinarily, they are switched in when they are running a little above or below synchronous speed. Consequently, there is a sudden rush of current such as would occur in a short-circuited transformer when switched on to a supply circuit on its primary side. In this case the rush on the primary induces a current through the rotor, which almost instantly pulls the rotor into step, and which soon dies down to its normal value. This current is a load current, and involves a large expenditure of power in the motor, so that the forces that come into play are very large. These forces exert very heavy stresses on the induction-motor windings, and may easily lead to a breakdown, especially with large machines. Two records are shown in fig. 4. In one of these, fig. 4 (*a*), the motor was switched in without great care being taken in synchronising it; the maximum current-rush is nearly 10 times the full-load current. In the other case great care was taken to bring the speed of the induction motor-generator to exactly its running value before the switch was closed. The initial rush is nearly the same, as far as it can be estimated from the curve, but the current dies down much more quickly to its steady value under these conditions.

In most circuits in this country long lengths of underground cable are used, which have a comparatively small inductance, and the effects observed on switching-in closely resemble what happens when a condenser is suddenly switched on to an inductive circuit.

An unloaded feeder is usually switched on by connecting it through a transformer to a number of generators. The transformer has considerable inductance due to magnetic leakage, and the generator also possesses inductance, so that the conditions existing may be represented by an inductive circuit which is suddenly connected to a condenser.

A 30-kw., 200-volt, 50-period alternator was connected to a condenser having a capacity of about 15 microfarads. In fig. 5 (*a*) there is a strong 19th harmonic. The curves of current and pressure for the two extreme cases (*i.e.*, switching-in at maximum pressure and zero pressure) are shown in fig. 5 (*a*) and (*b*). In fig. 5 (*a*) a strong current oscillation is observable with a frequency of about 800 periods per second, the maximum value of the current being nearly double that flowing under steady conditions.

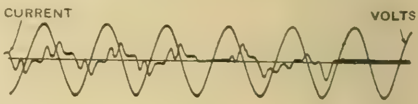


Fig. 7.

The case in which the values of the capacity and inductance are such as correspond to a natural frequency higher than the working frequency is illustrated in fig. 5 (*a*); this is the only case where there is any serious danger, and, of course, the condition of high natural frequency is much the most common. The surge depends upon the instant at which the switch is closed. Theoretically, it will, in most cases, be greatest when the switch is closed at the instant of maximum potential difference. This is clearly shown experimentally in fig. 5 (*a*) and (*b*). The maximum pressure-rise possible is nearly twice the maximum or peak value of the potential difference.

In the feeder-switching experiments the length of cable used was 3½ miles, and was designed for 6,600 volts between the three cores, with a capacity between each phase and earth of 0.27 mfd. per mile. Each core had a cross-section of 0.2 sq. in., and the outer sheathing was earthed. A switching-in curve is shown in fig. 6 (*a*). The surge is very small, and the conditions steady down after an extremely short interval.

In fig. 6 (*b*) is shown a switch-in which occurred near the instant of maximum potential difference. In this case also the surge is almost inappreciable on the record, probably due to its high frequency. The most interesting records have been obtained when the feeder is switched off. The charge on the cable does not die away continuously, but there is a low-frequency oscillation—in this case of about 12 periods per second. The instrument transformers remained connected after the cable was switched off, and the frequency observed corresponds to the natural frequency due to the instrument (volt) transformers and the cable, in series. The natural frequency of the circuit with instrument transformers only in circuit is, of course, much lower than that when the cables are switched on to the bus-bars.

A few oscillograms have been taken of the currents which flow between turbo-alternators when a 6-pole, 1,500-kw. machine is paralleled with a 6,000-kw. machine having four poles. The pressure waves of these machines are very nearly pure sine curves as shown in fig. 7, the most remarkable feature being the irregular shape of the wave of the current. In this curve a very strong fifth harmonic of current is present. The record shows the switch-off, and emphasises the fact that it takes two or three periods to open a circuit with the heavy gear required for controlling 1,500 KW.

The current which flows when the machine is paralleled depends upon two factors, *i.e.*, the phase relationship between the E.M.F. of the incoming machine and the bus-bar pressure, and the exact relative speed of the machines at the instant of closing circuit. In fig. 8 (*a*) the switch has been closed almost exactly at the right moment, and the current-rush is very small, there being very little phase-swing. In fig. 8 (*b*) there is a considerably greater phase swing. These two curves represent probably the limits of variation which may occur under ordinary working conditions with a good switchboard attendant. In fig. 8 (*b*) it will be noticed that there is a more or less regular period of increase and decrease in current. The period of this variation in current is approximately four-fifths of a second, and represents the natural period of swing of the alternator when running in parallel with a number of other machines. The curve shows the variation in phase difference between the circulating current and the pressure of the machine. After the instant of closing circuit in fig. 8 (*b*) there is an irregular current surge which dies down rapidly, and after about seven periods there is almost exact phase opposition between current and potential difference. This current, which is a motoring current for the machine, increases to a maximum, and then dies almost completely away except for a strong fifth harmonic, which still continues to flow round the circuit. During the next 10 periods the current circulating increases steadily, but it is now a generated or load current, being nearly in phase with the potential difference. It again falls to a minimum at the end of about 20 periods from the previous minimum, and the process is repeated.

A similar test was taken for a 1,500-KW. self-synchronising rotary converter, the record from which is shown in fig. 9. In this case the period of swing is shorter, about six periods between minimum and maximum motoring currents. This, of course, is what is to be expected, since the moment of inertia of the revolving mass is very much less than in a turbo-generator of the same capacity. The decrement of the swing also is much greater, the phasing current during the second phase-swing being much less than that during the first phase-swing. This machine was fitted with copper dampers on the poles, which greatly increase the damping of the oscillations. The maximum phase-swing current occurs at the time when the current and pressure are nearly 90 deg. out of phase, the first maximum current occurring when the current and pressure are 180 deg. out of phase. This current rapidly falls to a minimum, then rises and gives a maximum about five or six periods after the first minimum.

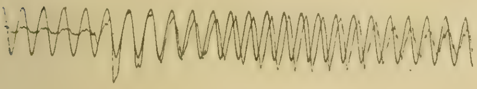


Fig. 9.

The author wishes to record his indebtedness to Mr. H. Dickinson, city electrical engineer to the Liverpool Corporation, to Mr. Robinson and Mr. Breach, the assistant engineers, and to Mr. Hamilton, the engineer-in-charge at Lister Drive, for their help and co-operation in carrying out the tests at the various stations and sub-stations where the work has been done.

Discussion.

Prof. J. A. **Fleming** expressed his pleasure at being able to listen to such a paper, and congratulated the author on the way he had dealt with the subject. About 25 years ago he himself had commenced to investigate the matter, with the result that he was able to come to a complete understanding as to the cause and action of these surges. At that time, of course, they had not the facilities or apparatus with which to deal with the subject that they had to-day, and very little was known about the matter at all. One experiment he had made with a transformer was to use a glow lamp so adjusted that under normal conditions it was just on the point of glowing. The transformer was then switched in and out several times in succession, with the result that every now and again the lamp would flash up and so indicate when the surges occurred. He had also used a Braun tube, and a third apparatus consisted of a stick of wood at each end of which was attached a flat wooden disc, one of which was placed against the transformer, and the other against the ear, as a sort of stethoscope. In this way the surges could be distinctly heard when they took place in the transformer. He thought that these surges were due to the undesirable state in which the iron was left when the transformer was switched off. He would like to see more work done on this subject, and that it should be extended to embrace switchgear, so as to eliminate if possible the surges and sparks which occurred when switchgear was opened and closed.

Mr. A. R. **Everest** said he had greatly enjoyed the paper, but he was not quite prepared to discuss the subject. It was possible that these surges might cause danger, or bring about troubles when switching in or out occurred. He would like to ask what measures, if any, could be suggested which would prevent the transformer iron being left in an undesirable condition as mentioned by the previous speaker.

Prof. J. T. **Morris** remarked that in the records taken on switching in induction motors by the author, only current rushes had been considered, but there existed also pressure surges, which were more dangerous. He was greatly interested to hear of the experiments carried out by Prof. Fleming in connection with current rises in transformers. He knew of a case where a moving coil, central zero, D.C. ammeter had been used on an A.C. circuit in such a way that the current was passed through the shunt of the ammeter. When normal the pointer vibrated slowly, but when a surge occurred it was at once indicated by a violent swing of the pointer. These surges, he had noticed, lasted for about 30 seconds with a 50-KW. transformer; with the lower frequencies and higher flux densities in use now these effects would be very much more marked, and he thought these surges would last about 10 minutes. He would like to know how long the author thought such surges would be likely to last.

Mr. H. **Brazil** was greatly interested in the paper, and mentioned records showing pressure surges which he had taken during the last 15 years. He described a horn arrester apparatus which he had designed himself, which, by sparking across the horns, showed when these surges occurred, but, unfortunately, it did not indicate their magnitude. An interesting fact was that rushes occurred between two sections of bus-bars; it was astonishing what a difference a short length of cable connected between the sections would make. With a length of 25 ft. of paper cable there was no appreciable rush, but with the same length of rubber cable a rush of 25 per cent. occurred. In the case of an induction motor being switched in an undoubted rush of current took place, as indicated by a spark between the horns of his apparatus, and also by a spark passing between the rotor and stator of the motor.

Prof. G. W. O. **Howe** expressed his appreciation of the paper, and congratulated the author upon it; he said that only those who had actually used an oscillograph could appreciate the amount of painstaking work the author must have put into the paper. There was not much information to be found on the subject dealt with by the author, and the few papers in which such information was given, owing to the patriotic attitude of those in charge of our libraries, were not at present accessible. With reference to fig. 4, he said the amplitude remained the same, and it was the ratio that differed. As to induction motors, the copper in the rotor acted as a screen, and the same rush took place independently of the speed of the motor.

Mr. **Taylor**, referring to the same figure, said that the surge was not so serious as might be thought; it would be very much more serious if cables had no capacity, and therefore were not able to discharge the energy stored up in them, which would result in a general destruction of switchgear.

Mr. C. H. **Wordingham**, President, said that many years ago he had similar experiences to those to which both the author and Prof. Fleming had referred. These surges were due to the state in which the iron was left when the transformer was shut down. It was not generally appreciated how great these surges could be at times; he had known them to be so great that the transformer actually jumped off the floor.

Prof. E. W. **Marchant**, replying, said that in a way he ought to apologise for presenting his paper, as it did not profess to put forward anything that was new. He was sorry he had not mentioned Prof. Fleming's and the President's work of 25 years ago. The problem of current rushes in transformers was becoming of great importance; there was far too little information on the question in connection with oil switches, and those who had the facilities ought to make as many tests as possible, which would be the means of gaining much knowledge on the subject. He thought the D.C. ammeter method described by Prof. Morris was of much interest; it was a very simple way of measuring the duration of these current surges. Under many conditions the surge effects would last a considerable time, possibly as long as 30 minutes, as indicated by the hum which was to be heard in transformers. The surges which occurred in induction motors were of great importance, but there was not much information about them to be had.

Synthetic Petrol.—In a paper read recently before the American Electrochemical Society, Mr. L. B. Cherry, an electrical engineer, gave some details of a process invented by him for producing synthetic petrol. The principle is to produce the chemical union of a gas, such as natural gas, composed largely of methane or hydrogen, with a hydrocarbon such as paraffin. It is claimed that, by subjecting the gas and paraffin vapour to a high-frequency, high-pressure electrical current, it is possible so to reorganise the molecules that a motor fuel of a petrol nature is obtainable.

Industrial Committees.—The *Times* states that the National Alliance of Employers and Employed is making special efforts to establish Joint Committees of employers and employed in Nottingham, Stafford, Bradford, Keighley, Liverpool, Edinburgh, Dundee, Glasgow, and Aberdeen.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE.—Among recent decisions issued by the Customs Department regarding the classification of certain articles under the French Tariff, are the following :—

Article.		*Classification.*
Electric accumulators, complete, for pocket electric lamps.	With box or jar of celluloid or similar material.	Small wares *tabletterie* of celluloid or similar material.
	Other	576 *ter.*—Electric accumulators and detached parts.
Dynamo brushes made of an alloy of copper and graphite		536. Dynamo armatures and detached parts.
Metal electrodes for soldering metals consisting of a rod or wire of iron covered with asbestos		535 *ter.*—Wires insulated for electricity composed of cores of iron, steel, &c., according to the diameter.
Pocket electric lamps covered with celluloid.		641 *bis.*—Small wares of celluloid.
Machines and apparatus for working and fashioning metals.		Note.—Saving disposition to the contrary, magnetic apparatus, with which certain machines are sometimes provided, are to be assessed for duty separately as electrotechnical apparatus.

SOUTH AFRICA.—The following are among decisions recently issued by the Commissioner of Customs :—

	Rate of import duty.	Rebate on goods manufactured or produced in the United Kingdom and reciprocating British Colonies.
Brazing spelter (brass fittings) ..	20 %, *ad val.*	3 %, *ad val.*
Bronze foil	3 % ,,	The whole duty.
Granulated lead	20 % ..	3 %, *ad val.*
Merrilite (zinc dust)	3 % ,,	The whole duty.

NICARAGUA.—As from November 18th last, the Nicaraguan Consular fees have been increased by 50 per cent. in each case, with the exception of the fees chargeable for the Consular *visa* on invoices, which are fixed as follows :—

Value of goods.	Cordobas.
Not exceeding 100 cordobas	2·50
Exceeding 100 but not exceeding 200 cordobas	3·00
,, 200 ,, ,, ,, 500 ,, ...	5·00
,, 500, one cordoba for each 100 cordobas or fraction thereof in excess of 500 cordobas.	

(Cordoba = 4s. 2d.)

BASUTOLAND, BECHUANALAND PROTECTORATE, AND SWAZILAND.—Proclamations have been issued providing that the increased Customs duties imposed in 1915, and re-imposed in 1916, are again re-imposed with a few exceptions, and will continue in force until June 30th, 1918, thus bringing the respective Tariffs of the above-mentioned Territories into line with the Union Tariff. (For particulars as to the electrical goods affected, see the ELECTRICAL REVIEW of September 15th, 1916.)

ITALY.—A Decree making provision for the payment of Customs duties in paper currency has been promulgated in the official *Gazette* of November 26th. As from that date, and until six months after the conclusion of peace, the sums payable in gold in respect of Customs duties may be paid direct to the Customs in paper currency with the addition of 50 per cent. of the amount payable.

The Minister of the Treasury is authorised to vary, by Decree, the amount of the percentage addition to be collected when Customs duties are paid in paper currency.

Amounts not exceeding 50 lire may be paid in silver dollars (*scudi*), and for sums not exceeding 5 lire the Customs are authorised to accept divisional silver Italian currency, or "buoni di cassa," without any addition.

The Decree suspends, during the period indicated above, all previous provisions relating to the delivery, by the banks of issue, of certificates for the payment of Customs duties against the deposit of paper currency for the amount due on the basis of the exchange rate fixed by the Minister.

UNITED STATES OF AMERICA.—The importation (except under licence) of the following among other articles into the United States has been prohibited by the President's Proclamation of November 28th :—Antimony and antimony ore, asbestos, chrome and chrome ore, cobalt and cobalt ore, ferro-alloys of all kinds, gutta-joolatong, gutta-percha, gutta-siak, balata, rubber (raw, reclaimed, waste or scrap), manganese and manganese ore, mica, molybdenum and molybdenum ore, nickel and nickel ore, platinum, plumbago, tin in bars, &c., tin ore and tin concentrates, titanium and titanium ore, tungsten and tungsten ore, vanadium and vanadium ore, and wolframite.

H.M. Ambassador at Washington has notified the Foreign Office that export licences are not required in the case of goods, of kinds prohibited to be exported from the United States, which arrive in ports of the United States under through bills of lading, and are there transhipped for ultimate destination in the United Kingdom, or a British Dominion or Possession.

Export licences *are* required in respect of consignments of export-prohibited goods which are shipped from the United Kingdom on through bills of lading for transhipment in a United States port to a foreign destination (*e.g.*, South or Central America). It is, however, anticipated that the United States authorities will grant such export licences freely.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,964. "Electric couplings and bases combined." R. W. BILL & W. T. BOWER. May 13th.

7,974. "Sound-amplifying device for telegraph relays." C. F. HILTON. May 13th.

7,978. "Trolleys or collectors for electric tramways, &c." E. R. THOMAS. May 13th.

7,985. "Signalling training." H. W. SCOTT. May 13th.

7,988. "Electric cut-outs." R. E. RAVEN. May 13th.

7,990. "Sparking-plug holder." W. OWEN & O. WILLIAMS. May 13th.

8,002. "Electric motor-control systems." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. AND L. MILLER. May 13th.

8,029. "Magnetos." COMPAGNIE GENERALE DE MAGNETOS. May 13th. (France, October 1st, 1917.)

8,036. "Flange joints for electric arc welding on thin materials." F. BROMLEY. May 14th.

8,038. "Electric water heaters." L. O. MEYER. May 14th.

8,047. "Dry non-acid accumulator." L. G. DAVIES. May 14th.

8,065/8,070. "Electric relays." A. C. HEAP. May 14th.

8,066. "Sound-detecting devices." A. C. HEAP. May 14th.

8,069. "Electric relays or switching devices." A. C. HEAP. May 14th.

8,081. "Electric generators." R. D. HOLT. May 14th.

8,082. "Magneto-electric ignition apparatus." D. Y. WHEATLEY. May 14th.

8,084. "Sparking plugs." J. M. E. FRANC. May 14th.

8,094. "Electric filament lamps." A. COPELIN & EDISON SWAN ELECTRIC CO. May 14th.

8,109/8,117. "Devices for locking electric lamps in bayonet-catch holders." W. A. MADDICK. May 15th.

8,118. "Brushes, &c., for electrical machinery." C. A. MILLER, F. J. MILLER & E. A. SANDERS. May 15th.

8,129. "Cells for secondary batteries." H. R. PEARSON. May 15th.

8,133. "Antennæ for wireless signalling." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) May 15th.

8,143. "Wireless telegraphic receiving apparatus." W. J. LYONS & SELECTIVE SIGNAL CO. May 15th.

8,161. "Miners' safety, &c., electric lamps." G. OLDHAM & J. OLDHAM. May 15th.

8,162. "Galvanic batteries." G. OLDHAM & J. OLDHAM. May 15th.

8,164. "Electric contacting devices." A. C. HEAP. May 15th.

8,168. "Electric lampholders." C. G. BENNETT & H. GARDE. May 15th.

8,169. "Electric switches." C. G. BENNETT & H. GARDE. May 15th.

8,176. "Charging boards for electric accumulators." H. LEITNER. May 15th.

8,182. "Electric light stick." E. A. DAVIS. May 16th.

8,188. "Contact-breakers on magnetos." W. TURNER. May 16th.

8,200. "Rotary electric machines." K. NOBUHARA. May 16th. (Japan, May 16th, 1917.)

8,201. "Electric stamping or pulverising machines." A. C. BASBE & R. E. SMART. May 16th.

8,207. "Electrolytic gas generators." I. H. LEVIN. May 16th. (U.S.A., May 22nd, 1917.)

8,220. "Electrotherapeutic apparatus." H. NETTER. May 16th. (France, May 16th, 1917.)

8,224. "Electrical precipitation." D. K. MORRIS & F. H. HAVILAND. May 16th.

8,226. "Control of alternating-current electric motors." J. ANDERSON AND G. ELLISON. May 16th.

8,227. "Junction boxes for electric circuits." H. E. WALKER. May 16th.

8,242. "Protection means for terminals of electric batteries." BRITISH EVER-READY CO. & A. H. SHEPPARD. May 16th.

8,273. "Electric induction furnaces." O. C. BOCKMAN. May 17th. (Norway, October 12th, 1917.)

8,287. "Radio-signalling system." L. DE FOREST. May 17th. (U.S.A., June 16th, 1917.)

8,290. "Electro-magnetically-controlled signal reverser for railways. R. W. TARRANT & W. R. SYKES INTERLOCKING SIGNAL CO. May 17th.

8,293. "Electric heating stoves." SOC. ANON. HECLA & H. A. COPE. May 17th.

8,300. "Electric dynamos." D. SUCHOSTAWER. May 17th.

8,318. "Audion or lamp relay or amplifying apparatus." M. LATOUR. May 17th. (France, October 23rd, 1916.)

8,324. "Electric engraving pencils." R. I. ELECTRICAL INSTRUMENT CO. AND A. M. ROBINSON. May 17th.

8,331. "Conductors for electric current." C. O. BASTIAN. May 17th.

8,334. "Dynamo-electric machines." G. FRYER & PORTABLE ELECTRIC MOTORS, LTD. May 17th.

8,348. "X-ray localisation." SIR J. M. DAVIDSON. May 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

8,150. CONTINUOUS-CURRENT DYNAMOS. F. Kesselring. June 8th, 1916. (115,045.)

17,593. APPARATUS FOR OPERATING DOOR BOLTS AND THE LIKE BY ELECTRICAL MEANS. E. C. R. Marks (Suddeutsche Telefon-Apparate Kabel und Drahtwerke Akt. Ges.). December 7th, 1916. (115,050.)

1917.

5,815. MINERS' ELECTRIC LAMPS. J. Davis & Son and W. H. Davis. April 25th, 1917. (115,084.)

6,094. SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 30th, 1917. (115,099.)

6,285. ELECTRIC WELDING APPARATUS. W. J. Mellersh-Jackson (T. E. Murray). May 3rd, 1917. (115,105.)

6,364. MEANS FOR AUTOMATICALLY RECORDING CALLS IN TELEPHONE SYSTEMS. A. E. Woods. May 4th, 1917. (115,107.)

6,802. PHASE CONVERSION OF ALTERNATING ELECTRIC CURRENTS. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 12th, 1917. (115,112.)

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NATIONAL ELECTRICITY SUPPLY.

ELSEWHERE in this issue we give an abstract of the report of the Board of Trade Committee on Electric Power Supply—a document of the first importance to all branches of the electrical industry, and, indeed, to almost every industry that is carried on in this country. It marks an epoch in the history of electricity supply in the United Kingdom, and if speedily acted upon—as we hope it will be—it will exercise an immense influence upon the future of that industry.

The general tendency of the Report was closely foreshadowed in the conclusions put forward by the Committee in May last year, on the basis of the reports of the Coal Conservation Sub-Committee of the Reconstruction Committee and the Electrical Trades Committee of the Board of Trade. The Electric Power Supply Committee then unanimously recognised the importance of reducing manufacturing costs to meet international competition after the war, the urgent necessity of a cheap and universal supply of electric power for this purpose, the inefficiency and inadequacy of the existing system of supply, which could only partly be alleviated by interconnection, and finally the need of the complete reorganisation of the supply industry as soon as possible.

It is with the last of these conclusions that the present report is mainly concerned. After broadly reviewing the subject in the light of the terms of reference, and justifying the conclusions summarised above, with the help of a trenchant letter from the Electrical Trades Committee to the President of the Board of Trade (dated January 19th, 1917), in which the appointment of a Board of Commissioners with ample powers was recommended, the Committee consigns the existing system to the scrap heap as "contrary to the national interest, wasteful of fuel resources," and detrimental to industry. Far wider and longer views than have been taken in the past are recommended, and it is laid down as an axiom that, in the interests of cheapness of supply, all consumers in industrial districts "*should unite in taking their supply from a common system.*" That may be taken as the key-note of the report, and it is in perfect harmony with the cry for co-operation which is heard on every hand throughout industrial and commercial circles In future the lone hand will be out of fashion, and it will be the duty of every man to "play for his side." In many cases it will involve a wrench, if only a sentimental one; duty seldom marches hand in hand with inclination, and not only corporations and companies, but individuals also, will feel that they are called upon to sacrifice their aspirations and ideals upon the altar of national advantage. They have our sincere sympathy, though we are fully convinced that none of them will suffer in a material sense.

The first step taken by the Committee towards the fulfilment of the terms of reference, we hardly need say is to recommend the *immediate* establishment of "one central authority to regulate generation and distribution" throughout, the United Kingdom, as a matter of urgency. On this point we think there is universal agreement. We may here recall the fact that this proposal was originally put forward in a paper submitted to the Institution of Electrical Engineers by Mr. E. T. Williams, in January, 1916, as an essential part of his comprehensive scheme for the reorganisation of electricity supply in this country. While the details of the Committee's scheme differ in many respects from the original plan developed by Mr. Williams, partly, perhaps, because he prudently abstained from advocating wholesale purchase and State assistance lest his views should be regarded as visionary and impracticable (two years ago)—the fact remains that he set the ball rolling, and he should be given due credit for a feat which might well have been regarded as outside the bounds of possibility. The pioneer work of Mr. R. A. Chattock in this connection also ought not to be overlooked; in his presidential address to the I.M.E.A. in June, 1914, he enunciated the broad principles which underlie the technical recommendations of the three Committees.

The Committee recommends the appointment of five Commissioners, of whom three should give their whole time to the work, with "substantial salaries, not less than £3,000 per annum"; "engineering qualifications and business experience of the highest order" are called for, and the work falling on the Commissioners is rightly regarded as likely to be heavy. Having regard to the commercial value of "engineering qualifications and business experience *of the highest order*," and the income that their possessors can count upon in private practice, the salary named is by no means excesssive; let us hope that a liberal interpretation will be placed on the words "not less than," for the duties and powers to be conferred upon these Commissioners do undoubtedly call for the appointment of the very ablest men that the country can provide.

The division of the country into districts, each controlled by a Board under the supervision of the Commissioners, follows on the lines of the Coal Conservation Committee's report, but the functions of the District Boards are more far-reaching; the recommendation that they should proceed to purchase *all* the "public utility" power stations in their areas is somewhat startling. It settles at one stroke a great many difficult problems, and the Committee is to be congratulated on the daring spirit in which it has dealt with this most important question. Private plants, it will be noted, are not to be purchased, but where new plant is installed it is to be subject to regulations to ensure that it shall fit in with the general system; the Committee clearly contemplates the supply of power at such a low price that private owners of generating plant will ultimately find it to their advantage to come on the public mains.

As regards "operation," it is left to the District Board, subject to the approval of the Commissioners, to decide whether it shall itself undertake the duties or lease the undertaking to a company. No preference for one or other of these alternatives is expressed in the Report, but an important pronouncement is made to the effect that if the former is adopted, the Board shall make no divisible profit. The same point is referred to later in connection with distribution; the majority of the Committee hold that municipal distributors should not seek to make a profit for the relief of local rates, and the minority agree that such profits should be limited to a small percentage. We have always maintained that electricity supply undertakings conducted by public bodies should not make profits, and we are glad to see this view endorsed by the Committee, which explicitly states that "the object to be kept in view is the cheapest possible supply of electricity for industry," which should not be hampered "by overcharging consumers of electricity for the benefit of other ratepayers." As regards the second alternative, the Committee repeatedly advocates the establishment of a community of interest between suppliers and consumers, suggesting that to this end the shareholders of the lessee company should be largely composed of the consumers in the district, and that the terms of the lease should include the regulation of profits on a sliding scale or other system. There is much to be said in favour of such a procedure, but we believe there will not be many cases where the municipal authorities, who will be strongly represented on the District Boards, will countenance the leasing of operation to a company. The North-East Coast is, of course, an exceptional case, unique of its kind in this country, and the Committee makes special reference to the low costs of supply over this wide area in support of the policy of centralisation. Provision is also made, somewhat furtively, for the continuance of supply by an undertaking which is already operating on a large scale and over a large area, a course which, no doubt, will be insisted on by such important undertakings as those of Manchester, Glasgow, Birmingham, &c. In our opinion, this is a policy of questionable merit; it will surely lead to controversy and wire-pulling, and if acted upon it will deprive the smaller communities adjacent to such an area of the benefits they ought to derive from their propinquity, unless, indeed, the big undertaking thus singled out is *compelled to supply the whole district*. Otherwise the absurd position in which the power companies were placed—namely, that of having powers to supply only the unprofitable areas outside the big towns—would be reconstituted, and that would be a fatal error. Suppose, for example, that Manchester Corporation is authorised to "carry on"; either it should supply the whole of the South Lancashire area, from a sufficient number of power stations, or else, if it is confined to its present area, the Board supplying the adjoining district will be in the undesirable position above mentioned.

With the constitution of the Boards and the methods of finance, both questions of the first importance, we have not space to deal on this occasion. We must, however, refer to the subject of distribution. The Committee recommends that this function should continue to be performed by the present distributors, if they so desire, and that the engineering staff of the distributors should co-operate with the engineers of the District Electricity Board, or its lessees, and says:—"The distributors must recognise that distribution is as important as generation, and requires the same skilled technical direction. *It would be a fatal policy if the distributors were to attempt to cut down their engineers' salaries, just when the new and cheaper bulk supply ought to make them busier than ever.*" (Our italics.)

We desire to emphasise this passage to the utmost of our power. We have dealt with the subject before on exactly the same lines, and we regard the matter as being of the first importance to the future success of the electricity supply industry, as well as to the peace of mind of the engineering staffs of existing undertakings. The prospects of the industry are almost unlimited, and, as the Committee points out, under the new *régime* there should be new and improved openings for engineers and other officials; our sympathies are with those who fear the contrary, but we are convinced that their doubts are entirely unfounded. The Committee quite rightly recommends that provision should be made for compensation for displaced officials in cases of hardship, but we believe that the demand for skilled engineers will be so pressing that their circumstances in life will be greatly and progressively improved. It will be observed that the duties of the Commissioners, in the opinion of the Committee, "should include the *encouragement* of the supply and distribution of electricity": as we have pointed out on previous occasions, it is useless to provide for indefinite expansion of the supply of electricity without correspondingly developing the demand, and there will be abundant scope at the distribution end of the undertaking for the exercise of engineering ability and commercial acumen.

The recommendations that the State shall assist in providing the necessary funds for new developments, that the latter shall be taken in hand immediately, that extended powers for the erection of overhead lines and for compulsory wayleaves should be conferred upon the Commissioners, that rating reforms shall be put in hand, and that water-rights for condensing purposes shall be secured, are all of the greatest importance, and we hope they will soon be embodied in an Act of Parliament; but the discussion of these and other matters must be deferred. For the moment we can only add a comment on an aspect of the subject which ought always to be kept in view as a matter of the first importance—the saving of fuel which can be counted upon to accompany the development of the scheme, and which is, indeed, one of its principal objects. Concurrently with economy in the generation of electricity there will come economies due to the abolition of small power plants, to the development of electric lighting, cooking, and heating, and to the electrification of railways, resulting in an aggregate saving which, we believe, when the new system is in full operation, will easily repay the whole of the additional capital outlay in a single year; this consideration alone would amply justify the recommendation of the Committee that the Government should not wait until prices have fallne, but should push on with the work of reorganisation and new construction without delay.

The I.E.E. Meeting.

An interesting incident at the annual general meeting of the Institution, last week, was the participation of Mr. G. Semenza, who is the local hon. secretary of the I.E.E. in Italy, and stands at the head of the electrical engineering profession in that land of sunshine, water-power, and lavish hospitality. Many of the members who took part in the memorable tour of the I.E.E. in Northern Italy, in 1903, will recall with pleasure the courtesy and assistance rendered to them by Mr Semenza, an Italian born in England, who was mainly responsible for the admirable organisation of the tour, and will join with us in welcoming him to London.

Referring to the metric system, which was under discussion, Mr. Semenza pointed out that our Italian Allies were anxious that Britain should take the place of Germany in their markets, but there was a serious obstacle to the fulfilment of that wish—namely, the English system of weights and measures. The adoption of the metric system, he said, was essential to success, and he urged that this was *a matter of the highest importance.* We commend this statement to the notice of our readers; coming from an Italian engineer, who is a sincere well-wisher of this country, and intimately conversant with trading conditions in Italy, it is of exceptional significance and weight.

Practically the only criticism of the Report of the Council at the meeting was that which was directed to the rather ambiguous reference to the metric system in connection with the Engineering Standards Committee's specifications. As published in the report, it stated in a roundabout way that the standard dimensions could be stated either in inches with metric equivalents added, or in metric measures alone, or in metric measures with inch equivalents added, as desired by the manufacturing interests concerned, and we did not think it worth while even to mention the matter in our abstract of the report. There is, however, one significant feature in this statement—namely, that the remaining alternative, that of stating the dimensions in inches alone, is conspicuously absent.

Export Trade Expansion Schemes.

The export trade expansion scheme advanced by Sir Charles Mandleberg, of Manchester, to which we have referred in some detail already, is making satisfactory progress. Our readers are aware that it is in no sense a specialised scheme for the trade in which they are interested, but obviously there is plenty of room for organised efforts on the part of general traders, as there is also for co-operative action among the large number of electrical firms who, either through ineligibility or indisposition, are outside the circle of what we understand as "the larger" electrical manufacturing firms. Up to the present, Sir Charles has not made any systematic effort to approach the general body of manufacturers, but he recognises what an excellent service the trade Press is able to render in making the matter known, and we believe that it is largely through such a medium that some 250 firms in various industries and in all parts of the country have associated themselves with the proposal, which, in essence, is for the establishment of a British Manufacturers' Corporation working on mutual lines with the object of placing manufacturers in a better position to extend their overseas trade after the war. A pamphlet has been issued giving the names, trades, and addresses of the firms who have entered into agreement to this end. They include a few electrical firms, and others interested in machine and engineers' tools, belting and packing, scientific instruments, elevators, vacuum cleaners, &c.—forming a not unimportant percentage of the whole. Sir Charles has not been precipitate in calling the preliminary meeting of supporters, owing to the general situation, but he is about to convene such a gathering so that a Provisional Committee may be appointed to formulate the scheme in detail. He invites manufacturers who are interested to communicate with him at once at Albion Works, Pendleton, Manchester. Firms who have not already made their export trade expansion plans, or are desirous of supplementing arrangements already entered into, should study our previous references to the proposal (Electrical Review, December 14th, 1917, February 8th, 1918), and, if necessary, apply to the promoter for further particulars.

Employment for Disabled Men.

One of the most important war problems before the country, both from the humanitarian and from the industrial point of view, is that of finding suitable employment for the sailors and soldiers who, in fighting our battles, have suffered bodily injuries which result in their partial disablement. Excellent work has been done by the Institution of Electrical Engineers, both in London and in some of the provincial centres, towards training disabled men in electrical work, and the Ministry of Pensions has made arrangements for the same purpose, with gratifying results. From time to time we have published articles dealing with the subject, and in this issue we give some particulars based upon the actual experience of a central station engineer, which indicate various classes of work for which certain kinds of disablement render a man unsuitable. Information of this kind is very useful, and as experience accumulates much more will become available. We trust that engineers employing disabled men will, for the sake of those who are yet to come, keep us informed as to any new openings that may be found for them, and give them the benefit of their experience. We may point out that it is not only in electricity supply that disabled men can be efficiently employed; in many manufacturing processes blind men, and deaf men, may be as useful as those who possess all their faculties unimpaired, and we owe it to them as a sacred duty to exert ourselves on their behalf.

DISABLED SOLDIERS AND THEIR EMPLOYMENT.

By "RESEARCH."

Until the war is over, a discharged soldier may be considered as a disabled soldier. The disablement may not be visible, but it prevents him being of use for active service, and also prevents him from taking strenuous jobs in civil life. Many of these men will have to find other work to do, and there are many jobs in the electrical supply business that they may become proficient at. After the war business will be more strenuous than in the past, if this country is to keep its place in the sun. Every man that can work must do so. The electrical supply business cannot find any place for men suffering from the following disablements: loss of both eyes, total loss of hearing, bad shell shock, loss of both legs, or very defective heart. Their lot must be made as happy as possible, and some of them may find light, special jobs to occupy them.

Employers and men are up against difficulties which must be overcome. Men are given jobs to do in which their disablement is eventually found to be a serious drawback. This is bad for all parties. The employer's enthusiasm in engaging disabled soldiers may be damped considerably, the man engaged feels the position keenly as his disablement is rubbed in, and much time spent in special training is wasted. Let us, therefore, consider the various positions and the disablement that disqualifies a man for a particular position :—

Position.	Disqualifying disablement.
1. Switchboard attendant. 2. Sub-station attendant. 3. Air compressor or hydraulic plant attendant. 4. Battery attendant.	Shell shock (steady nerves required). Heart bad (danger of electrical shock). Loss of arm (cannot work regulator handles). Loss of leg (cannot get about quickly when there is a breakdown). Loss of hearing (cannot detect things starting to go wrong by sound). Loss of smell (cannot smell machines or cables getting hot).
5. Engine driver. 6. Greaser.	Heart bad (hard work required). Loss of arm (cannot work regulators, &c.).
7. Stoker.	Loss of leg (cannot get about quick enough).
8. Meter or instrument repairer.	Loss of arm (full complement of fingers required).
9. Armature & coil winder.	Loss of eye (good eyesight required, and must be able to judge distances accurately).
10. Telephone work. 11. Bell work. 12. Signalling devices.	Loss of arm (both hands required). Loss of hearing.
13. Meter inspector.	Loss of leg, hearing, or eye.
14. Motor inspector.	Loss of leg, hearing, smell.
15. Motor repairer.	Loss of leg or arm, hearing, smell, bad heart.
16. Installation inspector.	Loss of leg, hearing, arm.
17. Installation complaints.	Loss of leg, arm, hearing, smell, bad heart.
18. Heater and cooker inspector.	Loss of leg, arm, hearing, smell.
19. Heater and cooker repairer.	Loss of arm, hearing, smell.
20. Mains fuse inspecting.	Loss of leg, arm, smell, bad heart.
21. Mains records.	Loss of arm, eye.
22. Meter tester.	Loss of arm, eye, hearing, smell.
23. Coal, water, and oil tester.	Loss of arm, hearing, smell.
24. Gateman. 25. Timekeeper. 26. Clerical work.	Loss of hearing, arm.

For the teaching and instructing of these men the ordinary routine is unsuitable. The aim of the ordinary technical class is to give a boy a varied electrical education extending over three to six years, which fits him for any branch of the electrical business. A man changing his business later on in life cannot spare all this time, and cannot expect to become proficient all round. He wants help to show him what branch of the business he will stand the most chance of becoming efficient at, and then special coaching in that branch of a very practical character. Long holiday periods must be cut out. Boys and men should not be taught together, as the man has forgotten much of what he learnt at school, and would not care to expose his ignorance before boys. The passing of examinations, whilst desirable, should not be pressed, as this may frighten some away from the classes.

The first three or six months might be spent in teaching elementary electricity and magnetism, with frequent visits to various works to enable the disabled soldier to see for himself the different branches and decide which one is the best for him. He should then receive special instruction in the branch he has chosen.

Studying the table of positions possible, it will be seen that they may be divided into four classes. Positions numbered 5, 6, 7, 24, 25, 26 do not require technical education. Of the remaining three classes, the first might comprise positions 1, 2, 3, and 4. The men choosing these positions would be on shift work, and special arrangements, if possible, should be made for the men missing one week out of three without losing touch with the lessons.

The next class might be called the inspectors' class, and comprise 10, 11, 12, 13, 14, 16, 18, 20, 21, 22. A knowledge of testing and what constitutes defects in apparatus would be necessary.

The final class would contain the repairers, positions 8, 9, 10, 11, 12, 15, 17, 19. A knowledge of testing and of the construction of apparatus is necessary for this, besides, of course, some mechanical skill.

Some suitable rules for the employment of disabled soldiers are necessary :—

1. Original employés now serving in the Army to have first claim to the most suitable job when they return. Disabled soldiers taken on must, if requested, obtain a position elsewhere to make room for the original employé. The employer could promise to give one to three months' notice to allow sufficient time to obtain another position.

2. The expense of prolonged stopping off duty through illness, probably necessitated by their injuries received whilst in the Army, not to be borne wholly by the employer, but should be provided for by the Government.

3. In learning a new job, small pay to be given for a short period and then full ordinary pay if evidence is shown by attending classes or studying that an earnest attempt is being made to become proficient.

The disabled soldier should take into consideration the following facts :—That as regards pay, if he is able to undertake the work of a fully qualified man, he is entitled to the full rate of pay. If, through lack of training or physical infirmity, he can only take the place of a woman or boy, he must be satisfied with a less pay. That bad time-keeping, from whatever cause, either prevents a person's employment, or two persons must be employed to do one person's work. That if time is spent in training a person in a new job the employer is entitled to that person's services, when efficient, for a little time afterwards at least. The employer, on his part, must remember that special patience must be shown and allowance made for these men who have passed through experiences such as never occurred before, and have sacrificed themselves for the safety, honour, and welfare of their country.

SOME INTERESTING FACTS RELATING TO LAMP RENEWALS.

By "ATLANTIC."

Cases come to the attention of all electrical contractors and others employing and installing lamps where apparently, for some undiscoverable reason, lighting installations show for some time a considerable number of burn-outs calling for a rate of renewal which is higher than normal. This higher rate of burn-outs and replacement quite frequently leads to dissatisfaction with lamps, and complaints as to their quality, and the tendency of the user is to lay the blame upon the lamps.

The following account of how lamp failures occur, with an explanation of the apparently high rate on new installations, may be of considerable value in showing that these variations in burning-outs and renewals of lamps are not necessarily due to poor lamp quality.

In a new installation it is quite generally found in service experience that for a long time after the lamps have been installed there is a variation or fluctuation in the rate of lamp burn-outs. This range of variation becomes less with the time of burning, until the rate of burn-outs and renewals finally becomes constant. Now, this variation, which is often attributed to inferior lamp quality, is shown by the following analysis to result from the burn-out characteristics of incandescent lamps.

Take, for instance, an installation in which all the lamps are new. During the first two or three hours of service a small percentage of the lamps will burn out. As the period of burning approaches the rated life of the lamps—*i.e.*, 800 to 1,000 hours—the rate of burn-outs will increase. Referring to fig. 1, the solid curve, which is known as the mortality or survivor curve, graphically represents the above principle. For example, for the first 200 to 300 hours of service the lamp failures, it will be noted, are comparatively few, but afterwards the rate of mortality steadily increases up to 200 to 300 hours beyond the average life (1,000) of all lamps. After this period the rate of mortality decreases continuously until the entire number of the initial lamps has failed. The broken line curve in fig. 1 represents the variation of the *rate* of burn-outs or renewals under the conditions represented by the solid-line curve. It will be noticed that this rate gradually increases and shows a maximum or peak point just beyond the average life period of the lamp (1,000 hours)—*i.e.*, at the life period, 1,200—1,300 hours. After this point the rate of lamp breakages declines till all the lamps are burnt out.

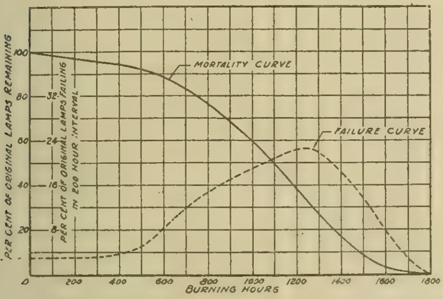

FIG. 1.—Diagram showing the normal condition affecting burn-outs of well-made incandescent lamps with an average life of about 1,000 hours. The solid line curve is the mortality or survivor curve, indicating the percentage of surviving lamps at each period of burning hours (shown on the horizontal scale). The dotted line curve is the failure curve, showing the percentage of lamps failing at each period of burning hours.

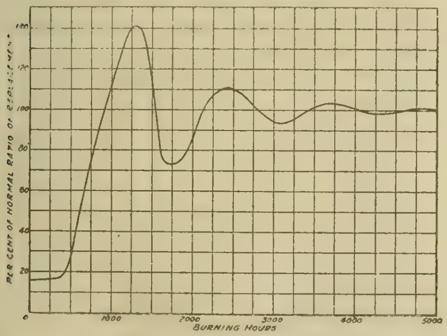

FIG. 2.—Diagram showing the fluctuations in lamp burn-outs after a new lighting installation is made, for a period up to 5,000 hours of service of the installation. This curve is plotted so as to show the percentage variation from the normal rate of burn-out which is represented by the 100 per cent. (horizontal) line. It will be seen that the rate of burn-out of lamps reaches a peak value of 140 per cent. at about 1,300 hours, and the fluctuations both above and below the normal rate of burn-out continue with the oscillations of the renewal rate curve, decreasing until they practically disappear at 4,000 to 5,000 hours of service of the installation; when the lamps settle down to the normal rate of burn-out represented by the 100 per cent. line.

To get the total lamp failures, we must take not only the failures of the original lamps, but the failures of the lamps replacing them, into consideration—*i.e.*, take all the failures both of new and replaced lamps. Now, if we take the normal rate of burn-outs and renewals as 100 per cent. and plot the total lamp burn-outs and renewals as a percentage of the normal rate of burn-outs, we have the curve shown in fig. 2. This curve very clearly illustrates the periodic fluctuation in the rate of lamp burn-outs. It will be seen that it starts with any new installation considered at very low percentages of the normal rate of burn-outs—*i.e.*, below 20 per cent.—and at about 400 hours the rate of burn-outs begins to grow very rapidly, rises fully to the normal rate of 100 per cent.; passes this, and goes up to 140 per cent. rate of burn-outs at about 1,400 hours. The rate of burn-out then declines to normal, and goes below normal to a 75 per cent. rate of burn-outs at about 1,750 hours. The rate of burn-out then rises again to a maximum rate of 110 per cent. of normal burn-outs at about 2,400 hours, and then the curve again declines to about 95 per cent. of normal at about 3,000 hours. As the time of burning goes on, the oscillations of this renewal rate curve show a decrease in range, and finally, at 4,000 to 5,000 hours' active use of the installation, the renewal rate, it is seen, becomes practically constant and normal.

It is thus clearly shown that for a period up to 4,000 to 5,000 hours' total use of a new lighting installation the rate of lamp renewals for certain included periods may be considerably higher than would be normally expected, and for certain other periods the rate may be lower than the normal rate. These swings in rate of burn-out tend to balance each other, so that if the full period of the use of the installation is taken the variation in the lamp burn-outs will be about the same as if the burn-out rate were normally constant from the beginning.

A study of the question by the aid of the curves is most useful, in showing that for every new installation a considerable rise in lamp burn-outs and renewals is to be expected in the first 1,200 hours' of use, and that the rate of renewal will be a maximum at between 1,000 and 1,400 hours for lamps having an average life of about 1,000 hours.

THE NEED FOR HYDRO-ELECTRIC DEVELOPMENT IN SPAIN.

[By Our Correspondent in Spain.]

The question of the utilisation of water power is now receiving marked attention in Spain from all quarters. It is doubtful if any other neutral country has suffered more during the war than Spain, where the appalling shortage of coal is little less than a national calamity.

Spain is dependent upon foreign supplies for about 2½ million tons of coal yearly, approximately 30 per cent. of her needs. During the past year hardly any coal from foreign sources has been available, and to shortage of foreign supply is added the prevailing lack of rolling stock and cargo boats, intensified again during the winter months (when coal is most needed) by snowstorms and delayed traffic on land and by foul weather and delayed traffic at sea.

The irony of the situation is that Spain is a country rich in water power. The hydro-electric power actually in use is not more than 250,000 KW., a little more than 8 per cent. of what it is possible to utilise on the large rivers alone. The total available water power is about 5,000,000 H.P., five times Mr. Newlands's estimate for the British Isles. It is true that the wholesale destruction of forests in past times has had a very detrimental effect upon the evenness of stream flow throughout Spain; an effect very keenly felt by Spanish agriculture at the present time, and it is becoming more clearly understood that the salvation of Spanish agriculture, by means of improved waterworks and irrigation, may also mean the development and salvation of Spanish manufacturies.

At the "National Congress of Irrigation," held in Seville during the second week in May, Senor Prado Palacio emphasised this point, and made an earnest appeal that hydro-electric development should go hand-in-hand with improved irrigation. He said, further, and with justifiable bitterness, "A country which for lack of coal pays to foreigners, in normal times, 4½ million pounds yearly merely to sustain her feeble and deficient industries; a country which buys from foreigners £56,000,000 worth of manufactured goods yearly, and more than £2,000,000 worth of cereals; which allows the treasures of her moving waters to escape, waters which half utilised would produce the moisture necessary for agriculture and the force needed for the production of articles for home consumption, would produce such riches, agricultural and industrial, that we could export instead of importing; such a country, I say, has no right to think, discuss, or act, on any subject until a plan for utilising our available water powers is thought out, discussed, and put in operation."

One of the best known authorities on the subject, Senor Irrutia, points out in his recently published study, "La Energia Hidroeléctrica de Espana," that 90 per cent. of the waterfalls are in the possession of speculators who have no intention of developing power, but are simply hanging on for a rise in value. It is likely that these speculators will have a rude awakening. According to *La Energia Eléctrica*, "The Minister of the Interior is now studying the subject, and will shortly present to the Cortes various projects, amongst them a general scheme of public works, construction of railways, and exploitation of mines. It is also proposed to legislate on the concession and development of waterfalls. Seeing the lack of coal in Spain, it is very necessary to stimulate the exploitation of new falls, and the Minister proposes to reform the law in the direction of nationalising the development of waterfalls, giving the State the right of expropriation of all those concessions which are not being worked. According to our information, it is proposed to divide Spain into zones, obliging the supply authorities of each zone to form a kind of 'trust,' with the ultimate object of nationalising those falls which are to-day in the hands of foreign capitalists."

Circumstances are forcing Spain along the path of progress. There is, however, a serious obstacle in the way, *i.e.*, the construction of large water turbines and electric generators. Hitherto these have been imported, but outside sources are not now available. One of the largest American makers of turbines recently wrote to me: "While there is a great need for water-power development in Spain as well as other countries, very little is being done just now, and until conditions change we do not look for an improvement." The same is true of British makers, and it is a matter for regret that they cannot seize the present opportunity. It is doubtful if Spain, unassisted, can manufacture all the necessary heavy machinery either this year or during the next five years, but assuredly she will try to do so. And after the war, as before, Germany will again be supreme in the Spanish field, while England will lose the greater part of the trade in coal, without any compensating increase in the supply of manufactured goods.

NATIONAL ELECTRICITY SUPPLY.

The report of the Committee appointed by the Board of Trade to consider the question of electric power supply was issued last week, as briefly mentioned in our "Notes," and can be obtained from H.M. Stationery Office at Imperial House, Kingsway, London, W.C. 2 (Cd. 9062. Price 3d. net.). The following is an abstract of the report:—

The terms of reference were as follows:—"To consider and report what steps should be taken, whether by legislation or otherwise, to insure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development."

The reports of the Coal-Conservation Sub-Committee of the Reconstruction Committee, and of the Electrical Trades Committee appointed by the Board of Trade, were laid before the Committee, which, on May 14th, 1917, unanimously came to the following conclusions:—

1. That when British industry is subjected to the test of keen international competition after the war, its success will depend upon the adoption of the most efficient methods and machinery, so as to reduce manufacturing costs as much as possible.

2. That a highly important element in reducing manufacturing costs will be the general extension of the use of electric power supplied at the lowest possible price, and it is by largely increasing the amount of power used in the industry that the average output per head, and, as a consequence, the wages of the worker, can be raised.

3. That the present system under which a supply of electricity is provided in a large number of small areas by separate authorities, is the result of a policy adopted at a time when the applied science of electrical engineering was in its infancy, and is incompatible with anything that can now be accepted as a technically sound system.

4. That the interconnection of existing electrical supply stations, recommended by the Board of Trade in their letter of May 25th, 1916, however desirable in itself, cannot alone meet the requirements of the situation.

5. That a comprehensive system for the generation of electricity, and, where necessary, re-organising its supply, should be established as soon as possible.

It was then decided to invite representative Associations throughout the country to give evidence with regard to the best methods of giving effect to these conclusions.

A letter was written by the Electrical Trades Committee to the President of the Board of Trade on January 19th, 1917, stating that witnesses had been unanimous in showing how greatly the electricity supply industry was now handicapped by the following facts:—

Electrical legislation in the past had restricted the proper expansion of the supply industry—the electrical areas were too parochial and entirely discordant from the economic area of electrical supply. The result has been a great growth of small uneconomical stations, with resultant waste of coal, and generally higher charges for energy than would have been the case from larger areas and greater concentration of plant in larger units, and more economically placed power stations.

Past lack of foresight in the granting of authority for the supply of electricity had allowed even adjacent undertakings to establish works differing, not only in type of plant and mains, but also in pressures and frequencies, with the result that linking-up and interchange of power was now extraordinarily difficult and costly.

There was no authority, nor any effective legislation, which empowered any authority to ensure that the best system should be adopted in the national interest in any district.

Electricity supply was of such vital importance to the military needs, and the industrial welfare of the nation, and to the future economy of coal, that the Committee felt it was essential that the direction of all matters concerning the future development of this industry should be in the hands of a new and independent Board of Commissioners, free from political control, and untrammelled by past traditions, to which should also be entrusted the general administration of the Electric Lighting Acts.

It has been conclusively proved that a municipal or Local Government area is rarely the most economical area of electrical supply; and the state of uncertainty as to whether or not action will be taken under the purchase provisions of the Electric Lighting Act, 1888, and as to their interpretation, has undoubtedly been adverse to the full and proper development of company undertakings subject to these provisions.

The right of veto exercisable by municipal authorities on the erection of overhead wires is another factor which has greatly militated against expansion and development, and has raised the cost of the electricity supplied.

Owing to the chaos of different systems, and the absence of any attempt to standardise pressures and frequencies, co-operation between neighbouring authorities is difficult and expensive. In London, for example, there are seven railway and tramway systems which generated electricity for the purposes of traction at differing frequencies—one at 50, two at 33⅓, and four at 25—thus rendering exchange of electricity between them impracticable except at the great expense involved in converting it.

Other causes have retarded electrical progress in the United Kingdom. Manufacturers have been slow to take a public supply of power partly through a mistaken reluctance to being dependent on others for anything they can make themselves. The same tendency has been shown in the past by most of the railway companies, but a change of view is taking place, and it is generally recognised that in electricity supply there must be more co-operation—less isolation—if the country is to progress with the rapidity which new circumstances demand.

To sum up as regards the present position, the evidence given was unanimous in declaring it to be unsatisfactory, and the opinion of practically every witness was that something must be done, and as speedily as possible.

The Committee has been impressed by the evidence placed before it with regard to the North-East Coast system. The costs of the electricity delivered over this wide area bear out in practice the contention as to the advantages to be gained by centralisation of the control of generation and main transmission over large areas. There are instances in the country of low costs in small areas where the load is very concentrated, but the object to be kept in view is not merely to have exceptionally low costs in one or two small and specially favoured spots, but rather to have the same or lower costs available over wide industrial areas.

The general consensus of the evidence given was that the need for the creation of one central authority to regulate the generation and distribution of electricity in Great Britain and Ireland is urgent, and that in the national interest steps should immediately be taken to establish it. With this view the Committee is in complete agreement. This new authority should be known as "The Electricity Commissioners." The powers connected with the generation and supply of electricity, at present exercised by the Board of Trade, Local Government Board, Local Government Board for Ireland, and Scottish Office, should be transferred to the Commissioners, who should be appointed by the President of the Board of Trade, and through him responsible to Parliament. They should be endowed with very full powers. Their duties should not be confined to framing and administering regulations and deciding questions brought before them, but should include the *encouragement* of the supply and distribution of electricity.

It is essential that the Commissioners should be men of high standing and ability. They should in the first instance be five in number. Three of these Commissioners should be appointed on the terms that they should not hold office beyond the age of 65; that they should have substantial salaries, not less than £3,000 per annum; and that their whole time should be given to the service. They should also have adequate pensions. The ordinary Treasury scale of pensions does not appear to be suitable in this case. The other two Commissioners might be appointed for a short term of years, and neither the age limit of 65, nor the right to a pension need apply to them. Engineering qualifications and business experience of the highest order should be represented in the personnel of the Commission. The staff employed should include a Secretary and such electrical engineers and inspectors as may be necessary. The work falling on the Commissioners at first, and for some years, is likely to be heavy, but it is probable that later three Commissioners will suffice. The whole expenses of the Electricity Commissioners might be recovered from the electricity undertakings of the country by a charge levied upon them *pro rata* to revenue.

As soon as possible after their appointment the Commissioners should proceed to delimit suitable electrical districts. The great industrial districts should first be dealt with, and especially those in which there is now no combined supply. It will not be necessary in the first instance to delimit districts in portions of the country where no important electrical development can immediately be anticipated.

The question is evidently very urgent in the Lancashire district, the area around and including Birmingham, and certain Yorkshire industrial districts. In London the matter has been pressing ever since 1905, when the question of reorganisation of the supply was raised in Parliament.

The most satisfactory scheme must be based upon single ownership in each district of the generating stations and main transmission system. In the national interest, generating stations and main transmission lines ought, as a general rule, to be publicly owned, and for this purpose a District Electricity Board should be set up in each of the districts when constituted, to which the generation and main transmission system should be transferred. The Order of the Commissioners which delimits the district should incorporate the District Electricity Board. The District Electricity Boards should be established:—

(*a*) To acquire all the generating stations and main transmission systems within their districts (excepting stations for private supply).

(*b*) To link up and develop the supply of electricity.

(*c*) To erect new stations as and where necessary.

(*d*) To acquire and utilise wherever practicable surplus electricity, and waste gas and heat, and other sources of power.

District Electricity Boards should have power to acquire generating plants of magnitude at present owned by railways, tramways, or other public utility concerns, and the supply to these undertakings should be combined with that to other consumers of power. Main line electrification may not take place immediately, but will undoubtedly come. Meantime, large extensions of the use of electric power for railways in connection with urban, suburban, and special goods traffic, are imminent. The importance of combining the supply to railways, tramways, and other classes of consumers, is beyond doubt, and each of them will benefit thereby. Combination will also save duplication of capital expenditure on reserve generating plant which would otherwise be necessary.

It is not suggested that there should be restrictions in regard to ownership or the setting-up of private installations, where electricity is generated for the owner's own use, and not for sale. However, in cases where new private generating plant is installed, it should be subject to regulations of the Commissioners as to type of current, frequency and voltage, in order that it may fit in with the general system.

The installation and extension of the generating plant and main transmission lines, and the management and working thereof, included under the term "operation," should be carried out:—

1. By the District Electricity Board.
2. By a company under lease from the District Electricity Board, such company preferably to be composed largely of consumers within the area affected.
3. By an existing power company under lease from the District Electricity Board.

The method of operation should be decided by the District Electricity Board, and should be subject to the approval of the Commissioners, to whom appeal by those interested may be made. Whichever method is decided upon should apply to the whole district.

If the first method be adopted, then, as the object aimed at is the supply of electricity at the lowest possible price, it is essential that the District Electricity Board should make no divisible profit.

The transfer of the whole of the electricity undertakings from their present owners to the Boards will be a large operation, and will involve the raising of considerable sums in future for extensions and new generating stations. It may be necessary to finance the Boards in whole or in part by funds raised with Government assistance, or, on the other hand, it may be possible to finance the Boards locally without resort to such assistance.

Boards might be of three types:—(*a*) Nationally financed, (*b*) locally financed, (*c*) mixed boards, *i.e.*, a combination of (*a*) and (*b*) in varying proportions. In every case the Boards shall be as small in size as possible. This policy will tend to secure the selection of the most suitable persons, and will otherwise conduce to efficiency.

District Electricity Boards which are *nationally financed* should be composed of representatives of the local authorities now supplying electricity within the district selected by ballot of an electoral body nominated *ad hoc* by the several authorities every three years; of companies (including power companies) distributing electricity, selected by an electoral body formed under regulations of the Electricity Commissioners; of consumers paying £200 per annum or over for electricity, elected under regulations framed by the Electricity Commissioners; and of the railway companies using electricity within the district.

Power should be given to the Commissioners to fix by Order the proportion of the representation of each interest in a district.

If a satisfactory scheme for a *locally financed* or mixed Board is proposed for the district and accepted by the Commissioners, when settling the proportion of representation of each interest on the Board, they would necessarily take into account the financial responsibilities undertaken by those bodies which become responsible for providing the capital to buy out existing generating stations and/or undertakings, and to construct new stations and main transmission lines.

It may be advisable in an exceptional district, the outstanding feature of which is an undertaking, whether municipal or company, already supplying power on a large scale and over a large area, and able and willing to develop that supply at its own risk, that the municipal authority or the company, as the case may be, should continue, subject to conditions laid down by the Commissioners.

All generating stations belonging to local authorities, electric lighting companies, and power companies should ultimately be taken over by the District Electricity Board—good and bad. The terms should generally be payment of the actual amount expended on lands, buildings, and plant for generating purposes, less depreciation, reserve funds, renewal funds, and sinking funds which have been provided, and which are properly applicable to the generating stations.

In the case of railways, tramways, docks, and other public utility undertakings, the District Electricity Board should have power to take over the generating stations, but an undertaking should in such cases be given that electricity will be supplied to them at least as cheaply as they could have produced it themselves.

The District Electricity Board may realise any generating stations taken over which are not required, and acquire new sites, erect new stations, and lay new main transmission lines.

With regard to distribution systems, in the case of the local authorities the distribution system may be acquired on terms similar to those proposed in respect of generating stations, in cases where distributors wish to discontinue.

In the case of electric lighting companies, distribution should either by transferred to the District Electricity Board on terms fixed by agreement, or should remain in the hands of the company until the earliest date at which the concession may be terminated.

In the case of the power companies, in some instances, it may be suitable also to buy their distribution systems by agreement. The Board should have, in addition to the powers of the power company, the right to distribute energy for lighting, as well as power, in those places where there is no lighting supply.

In all cases where the distribution system is not acquired the District Electricity Board must undertake to supply the distributors with electricity at least as cheaply as they could have produced it themselves in similar circumstances.

Except in the case of the transfer of undertakings owned by local authorities, in which case the purchase price should be discharged by a terminable annuity to be used by the local authority in discharging their loan obligations, payments should be made in cash, which, in the case of nationally financed Boards, would be provided by issues of electricity stock through the Treasury.

The District Electricity Boards should have powers of laying main transmission lines throughout their areas, and powers of distribution in all parts of their areas where there is now no public supply.

In order to ensure that the business of the District Electricity Boards is conducted under proper financial safeguards, provision should be made for supervision by the Electricity Commissioners.

In cases where operation by a commercial company may be found preferable the District Electricity Board may lease their undertaking on terms to be approved by the Commissioners. The terms of any lease should provide, *inter alia*, for the regulation of the amount of the distributable profits by the imposition of a sliding scale, a system of rebates to consumers, or otherwise, as may seem best calculated to secure a community of interest between the lessees and consumers.

A scheme of public ownership and company operation was prepared by the London County Council and deposited as a Bill in the Session of 1915, but not proceeded with. There is no part of the United Kingdom in which combination in supplying electricity is more urgently required in the public interest. It is to be regretted that both the municipalities and the companies operating in the County of London have made so little use of the existing facilities for combination given to them in the Acts of 1908 and 1910, and more drastic steps than those proposed by the London County Council in 1915 are now called for.

Distribution, especially in the case of the larger towns, should generally be left in the hands of present distributors, unless they wish to transfer it. Municipalities and other local authorities should distribute electricity without seeking to make a profit for the relief of local rates. It is undesirable to hamper industry by overcharging consumers of electricity for the benefit of other ratepayers.

The District Electricity Board, or its lessees, should be advised by engineers of the highest standing, whose advice and assistance should be available in connection with the distribution as well as the generation of electricity. The distributors must recognise that distribution is as important as generation, and requires the same skilled technical direction. It would be a fatal policy if the distributors were to attempt to cut down their engineers' salaries, just when the new and cheaper bulk supply ought to make them busier than ever.

Although under the Committee's proposals and the development which may be expected to flow from them, there should be new and improved openings for engineers and other officials, provision should be made by which District Electricity Boards may provide compensation for displaced engineers and other officials in cases of hardship.

The Electricity Commissioners should have considerable powers to make final Orders, and new Orders authorising the supply of electricity under the Electric Lighting Acts in areas with a population of less than 5,000 should not require confirmation by Parliament. This would enable the many non-statutory undertakings which exist, especially in small towns in Ireland, to be put on a legal basis at small cost. But where an Order is proposed to be made which involves changes of magnitude, those affected should have a right of appeal to Parliament.

An approximate statement of the capital invested in public electricity enterprises is given below for the year 1916. There were at that time 230 companies and 327 local authorities operating undertakings under statutory authority for the supply of electricity to the public. Their capital expenditure had been:—Companies £36,000,000, local authorities £55,000,000; total, £91,000,000. A large percentage of this total has been expended on the distribution systems, which in most cases will not be transferred. The average percentage of expenditure on lands, buildings, and plant for generating purposes is a little under 50 per cent. of the total.

The cost of the developments undertaken during and immediately after the war will be greatly enhanced by the abnormally high cost of materials. It is generally expected that high prices will prevail for some time after the conclusion of peace. The postponement of all developments until a time when prices have receded to what may be considered a normal level would be most regrettable. The provision of adequate electric power is required for the resuscitation of industry. The problem caused by abnormal costs of new work must be faced. The benefit of industrial activity in the years immediately following the war will be of immense importance to the nation and anything that contributes to it will be of general advantage. The Committee therefore recommends that the Government should go a long way in giving financial assistance, so that installations which are known to be urgently required, and which are undertaken during a time when the cost of manufacture and erection is admittedly abnormal, should not be unduly burdened by charges for interest and amortisation. The Committee emphasises the vital importance of the matter.

The future development of electricity in many districts will depend largely upon facilities being granted for the use of overhead lines, and it is of vital importance that restrictions which exist at the present time should be removed or amended. It will not only tend to cheapen the supply to consumers in industrial districts, but will also be an important factor in developing the use of electricity for agricultural purposes. The powers of the Board of Trade, which would be transferred to the Electricity Commissioners, should be a sufficient protection against overhead lines being placed along routes which are undesirable. Whilst the local authority should have a voice in regard to such matters, their absolute veto on the construction of overhead lines should be abolished.

Further facilities should be afforded for the placing of electric lines, either underground or overhead, across private property. Undertakers are at present dependent on obtaining wayleaves from owners or lessees. This restriction has been found in many instances to result in difficulties in arranging for suitable routes across country, owing to the arbitrary action of landowners and lessees in absolutely refusing to consider applications for wayleaves or in demanding exorbitant rents, or making unreasonable conditions. One landowner or lessee is thus in a position to compel an electric supply authority to make alterations in route in respect of which consent had been obtained from other landowners, or even bring about the abandonment of the proposed supply, owing to the heavy additional costs which would be incurred by having to adopt a more circuitous route. Power should be given to the Electricity Commissioners to authorise the placing of electric lines over, under, or across any private lands, and that the compensation should be assessed by arbitration after the work has been done, in the same manner as compensation is assessed for the laying of sewers under the Public Health Acts. The existing statutory provisions for the protection of telegraphic and telephonic wires should be revised with a view to modifying the present restrictions.

The local rating system as applied to electric transmission mains must greatly, and unjustifiably, interfere with the supply of cheap power, and enhance its cost. As the use of electricity has come in since the Acts on Valuation and Rating were framed, it seems necessary that they should be revised. Their application to electricity undertakings and appliances should be settled on economically sound principles and clearly defined. The matter is one which calls for the immediate attention of the Government.

The importance of water for condensing purposes cannot be over-estimated, and facilities should be afforded for the acquisition on equitable terms of rights to use water, other than potable, particularly from canals and other navigable waters.

The Electrical Trades Committee in its report states that the national advantages to be gained from a well planned scheme of reconstruction will be inestimable. "The items which are capable of reasonable calculation such as saving in fuel, reduction in factory costs, and increased output, will together represent not less than £100,000,000 per annum," and "witnesses of high authority estimate the loss incurred by the nation through failure to take full advantage of electrical progress at not less than £100,000,000 a year, a loss preventable by concentrating generation under improved administration." As a result of the improvements recommended, and the development which may be expected to proceed from them, the use of electricity for domestic purposes, such as lighting, heating, cooking, and small power, will greatly increase. The cumulative effect of a really cheap supply of electricity, on town conditions in particular, would be most marked. The saving of labour would be great, while the reduction of air pollution by smoke would result in a lower death rate from bronchial diseases and phthisis. It has been estimated that the measurable damage done to property in Manchester and Salford alone, by smoke, amounts to nearly £1,000,000 per annum. This is equivalent to about £1 per head of the population. The results of a recent similar inquiry in Pittsburg, U.S.A., show a very much larger proportionate figure. Even allowing that only a portion of smoke damage could be avoided, the saving would be large.

In view of the fact that the numerous investigations of the Reconstruction Committees, and the proposals made by them, must largely depend for their practical effect upon the supply of cheap power, the Committee in conclusion emphasises the importance of initiating the necessary legislation with the least possible delay.

The report is signed by Sir Archibald Williamson (Chairman), Mr. H. Booth, Dr. J. F. Crowley, Messrs. J. Devonshire, Harold Dickinson, James Falconer, G. H. Hume, John Kemp, Vesey Knox, H. H. Law, C. H. Merz, Sir Charles A. Parsons, Ald. C. F. Spencer, Mr. W. B. Smith, Sir John Snell, and Mr. A. J. Walter.

Tramway Workers and Industrial Councils.—The annual conference of the Amalgamated Association of Tramway and Vehicle Workers, at Birmingham, approved of the executive's action in affiliating with the National Transport Workers' Federation, and proceeded to discuss the question of the setting-up of Industrial Councils on the lines of the Whitley Report. The general secretary reported that as the result of conferences with the Municipal Tramways Association and the Tramways and Light Railways Association a joint Sub-Committee was appointed to draft a scheme. The present District Councils of the Association will form the backbone of the District Industrial Council under the scheme.

LEGAL.

Workmen's Compensation Case.

At Preston County Court, last week, Judge Sturges gave judgment in a compensation action brought by Mrs. Bessie Gilleard, a lathe hand, against Messrs. Dick, Kerr & Co. for injuries to her hand caused by an accident, which she claimed had arisen out of and in the course of her employment. Concealing her tea-can in the gear box of an adjoining machine to prevent it being stolen or used, she got her fingers trapped and damaged. The answer was that the accident did not arise out of the woman's employment, and that she was not authorised to tamper with the gear box in any way.

Judge Sturges said he was bound by the decision of the Court of Appeal in a similar case, which was that the workman was not entitled to recover, and accordingly he entered judgment for the respondents.

Colliery Manager Fined.

At Wakefield, on May 31st, F. H. Waterhouse, manager of Crigglestone Colliery, was fined £5, and £13 16s. 6d. costs, for a breach of the Electricity Regulations under the Coal Mines Act, by failure to provide automatic switches to cut off the current. Two men were injured by a fault which occurred in January. The defence was that Mr. Waterhouse had been endeavouring to get the switches ever since the electric system was installed in the spring of 1917, but had been unsuccessful owing to the manufacturers being on war work.

Farley and others *v.* Truscott.

Electric Fittings Landlord's Fixtures.

Mr. Justice Rowlatt in the King's Bench Division, on May 29th, heard an action which raised an interesting question as to whether electric lighting fittings put up by the tenant were the property of the landlord or the tenant. The case took the form of a claim for an injunction to restrain the defendant from removing the electric light fittings from a house at Canterbury, of which he had been tenant. It appeared that the electric installation was in the house when defendant took it, but the fittings, being obsolete, were removed and stored for the landlord, and others were put up in their place at the tenant's expense, and he claimed the right to remove them. The plaintiff, on the other hand, contended that under the terms of the lease they, with all other fixtures, became his property, even including the electric bulbs and pendants.

With regard to the bulbs, His Lordship observed that the landlord might just as well claim that a tenant could not remove candle from candlesticks fixed to the walls, or hats from hat rails similarly fixed.

Counsel for the defence said that it had been laid down that lamp shades, globes, and bulbs were chattels, and therefore the tenant's property.

His Lordship, after having heard arguments on both sides, said that the plaintiff was entitled to succeed. The matter turned entirely upon the construction of the lease, and especially upon the construction of the covenant which provided that the tenant should surrender and yield up the fixtures which at the date of the lease, or at any time during the term, "shall be thereon." The word "fixtures," as he understood it, meant something other than chattels. Although the globes, shades, and bulbs might be the tenant's property, the lamps themselves, if they were in any way attached to the freehold, were not. The tenant's fixtures, too, became the property of the landlord unless they were removed during the tenancy, and in this case they were not so removed. Moreover, in this case the words of the covenant excluded the right of the tenant to remove any fixtures. The plaintiff was therefore entitled to succeed in his action, but the tenant was entitled to claim all bulbs, shades, and globes.

Judgment was entered for the plaintiff, with costs.

Forbes *v.* M. & B. Kinemas, Ltd.

In the City of London Court, on June 4th, before his Honour Judge Rentoul, Mr. Archibald S. Forbes, electrical engineer of Clapham Park, sued M. & B. Kinemas, Ltd., 46, Gresham Street, E.C., for £11 for repairing two dynamos, wiring up, &c., for kinema arcs, repairing small projector motors, and other work.

Mr. Sinclair Cox, for the plaintiff, said that defendants owned a picture palace known as "The Better 'Ole." Plaintiff's case was that he made it a "better hole still" by doing a considerable amount of work in connection with their electrical system. He was in the service of an electric supply company, and the work for the defendants was done in his spare time. For 60 days he worked for the defendants from time to time. On six occasions he worked through the night, and once he worked right on till 2.30 next afternoon. He reckoned that he spent about 300 hours, and his charge worked out at 9d. per hour, which was very small for an electrical engineer of any skill at all.

Plaintiff said that he was not a member of an electrical institution, but he had passed an examination at the Polytechnic, Birmingham, some years ago, and was now a shift engineer in charge of a sub-station.

Mr. H. Roger Sadd, for the defendants, said that £1 had been paid, and defendants had paid £4 into Court, which was enough to satisfy plaintiff's claim.

Judge Rentoul, K.C., found for plaintiff for £7 10s.

WAR ITEMS.

Wounded Soldiers Entertained.—The employés of the Phœnix Dynamo Manufacturing Co., Ltd., of Thornbury, provided a tea and evening's entertainment on Saturday week, for patients at the local military hospital.

Trading with the Enemy.—The "London Gazette" for May 31st contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay; Bolivia; Brazil; Chile; Colombia; Ecuador; Guatemala; Hayti and Dominican Republics; Mexico; Netherlands; Netherlands East Indies; Nicaragua; Norway; Peru; Salvador; Spain; Venezuela.

The Askwith Award and Uncertified Undertakings.—A Munitions Tribunal was held at Exeter on Monday to hear a complaint of the National Union of General Workers against the Exeter Corporation (Electricity Department) of alleged failure to conform to an award made in respect of employés on the production and distribution of electricity. The award was 15s. a week on pre-war rates as from August, 1917, and 20s. per week as from the first full pay in December, 1917. The proceedings affected about 14 men. Mr. G. H. Young, Southern District Organiser, said when they were before the Committee on Production the Chairman of the Exeter Electric Light Committee stated that the Committee felt that it was bound by the Askwith award. Mr. G. B. Allon, Deputy Town Clerk, denied that any such admission was made. The Tribunal held that the question to be gone into was whether the Askwith award applied only to certified undertakings, or applied to all electricity undertakings, or whether it applied only to certified undertakings and electricity undertakings which were supplying munition works. Another point was that if the award did apply, did it merge in the Committee on Production's award, or, if it did not, whether the evidence as to any statement made accepting responsibility for the 12½ per cent. bonus made it apply. These were matters which would have to be gone into very carefully. The Tribunal wished to see the Chairman of the Electricity Committee, and to read the shorthand notes of the proceedings before the Committee on Production. The case was adjourned for a fortnight.

Building After the War.—The Committee of the Ministry of Reconstruction which is making an inquiry throughout the country from local authorities, builders, architects, and others as to the probable demand for, and supply of, building materials during the reconstruction period two years after the war, has extended until July 1st, 1918, the date upon which the inquiry forms already sent out are to be returned. The Committee hopes that any authority, person, or firm contemplating building works immediately after the war who has not received one of the Committee's forms of inquiry will apply, either directly or through an architect, to the Secretary of the Building Materials Supply Committee, 6a, Dean's Yard, Westminster, for a form. In cases where only sketch plans have been prepared, and the preparation of complete plans and bills of quantities has been postponed until after the cessation of hostilities, it would appear that no materials will be required until at least six months after the war, and as regards these works it will suffice if the undermentioned particulars are furnished:—

County.
Description of building.
Estimated pre-war value of the work.
Estimated date of commencement of building.
Estimated duration of contract.

Wherever possible, however, approximate quantities of materials needed should be furnished, especially in the case of building stone and bricks, steel, and timber. Materials needed for repairs, maintenance, &c., form the subject of a special inquiry, and particulars of these are not needed at present. In other matters, however, it is hoped that every effort will be made to complete forms of inquiry by the date specified. Unless the Committee is made fully aware of the prospective needs of consumers, it will not be possible to estimate how far the available supplies will meet the demand, and its efforts to secure co-ordination may thus prove unsuccessful.

Exemption Applications.—The National Service Representative asked the Fulham Tribunal to review the certificate of conditional exemption granted to Mr. S. J. W. Scott, electrical engineer, 36 years of age, married, and passed for general service. He stated that he was working at the Belgian Refugees' Camp, Earl's Court, attending to the electrical plant in the camp and workshops. He was a member of the V.T.C., and devoted a considerable part of his time to anti-aircraft work. The Tribunal cancelled the certificate, but notice of appeal was given.

At Southport, exemption was claimed by a fireman (36, Grade 1) in the electricity department of the Corporation, but he was ordered to report for service by July 1st.

At Newcastle-under-Lyme, exemption was sought by the partner in a firm of electrical engineers, and he was given until the end of June to be graded.

At Oxford, the Electric Tramway Co. appealed for V. Hill (36, Grade 2), foreman driver, and three months' temporary exemption was allowed.

At Torquay, in an appeal by H. W. Drury (Grade 2), electrical engineer, it was decided that he should be available for service by July 1st, and it was recommended that he should be employed in his profession.

At Burnley, an electrical engineer (37, B 1), who appealed for exemption, claimed to be in a certified occupation, and said that his workman had been badged. His business was mainly maintenance work, and if he had to go into the Army it would have to close. He was given until the end of August.

Before the Somerset Appeal Court, the Porlock and District Electric Light Co., Ltd., appealed for the retention until July 1st of S. H. Arnold (26, Grade 1), engineer in sole charge of the power plant. It was stated that the loss of Arnold would mean the closing down of the business, and the company asked for a little time to get their affairs settled. It was decided that Arnold should be available for service by July 1st.

At Amersham, the National Service Representative withdrew an appeal he had lodged against E. Band (31, Grade 2), electrical engineer, of Wedmore.

At Burnham-on-Sea, exemption was refused to C. E. King, shift engineer and switchboard attendant at the electricity works.

An appeal was made to the Dorset Appeal Court, at Dorchester, by T. H. Escott, branch manager for Messrs. Brooking & Co., electrical engineers of Weymouth, and he was given exemption until the end of August.

At Grange, the National Service Representative appealed against exemption held by E. S. Brown (27), electrical fitter with Mr. T. Wilkinson. The appeal was assented to, and the exemption cancelled.

At Canterbury, the National Service Representative appealed against exemption to August 13th granted to S. Terry (29), electrician, of St. Dunstan's Street. The case was heard *in camera*, and the appeal was allowed, but respondent is not to be called up until August 13th.

The West Kent Appeal Court has granted two months' exemption pending substitution to C. F. Mounsden (34, Grade A), engineer to the Sevenoaks and District Electricity Co., on the understanding that every effort was made to obtain someone to release him.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Future of Small-Station Managers.

A Government Report has recently been issued recommending drastic changes in the organisation and administration of supply undertakings. As is well known, the scheme involves the supersession of small generating stations and the amalgamation of adjacent supply areas.

While this matter has been discussed in the Press for months, nothing appears to have been put forward regarding the method of dealing with the existing administrative staffs. No doubt many of the managers of the larger undertakings will secure remunerative berths under the new *régime*, but what is to happen to the engineers connected with the smaller schemes? Many of these men have held their positions for a number of years and are getting past the first blush of youth, or for other reasons would find considerable difficulty in securing suitable employment elsewhere. Further, for years past such engineers have been grossly underpaid, so that they have not been in a position to put by for the proverbial rainy day, and, moreover, some have young families to start out in life. Electrical engineers, as a body, have been too jealous of their professional reputation, and have looked upon the practice of their profession as something more than a mere wage-earning business, and, therefore, have not adopted Trade Union methods. Had they done so they would doubtless be in better circumstances to-day, and, moreover, would have the advantage of a powerful organisation behind them to ensure that justice was done them.

I believe it is the solemn duty of the Institution of Electrical Engineers to take such steps as will ensure that all those engineers who are deposed shall be properly compensated. It is, doubtless, within the memory of many that in the past, in cases where offices have been abolished due to amalgamation of districts, and so on, the compensation or pensions awarded to the holders of the offices has been ludicrously inadequate. Unless drastic steps are taken at once it appears that similar injustices will be perpetrated in the near future.

Wm. J. U. Sowter.

Bray, *June 3rd*, 1918.

[We refer to this matter in our leader to-day.—Eds. Elec. Rev.]

BUSINESS NOTES.

Non-Ferrous Metals Licences.—A list of companies, firms, or individuals to whom licences have been granted by the Board of Trade under the Non-Ferrous Metal Industry Act, 1918, appears in the *London Gazette* for May 31st.

German Lightning Conductor Makers.—The latest syndicate to be formed in Germany is one embracing all the principal makers of lightning conductors in the country. It is known as the Verband Deutscher Blitzableiterfirma.

South African Mines.—The official returns of electrical machinery and energy supplied to the mines of the Union of South Africa during 1917, as compiled by the Mines Department, are as follows :—

Electrical machinery, including spares	£369,781
Electric power and light purchased	£1,376,088
Electric detonators or fuses	£11,645

—*South African Mining Journal.*

Trade Representation Abroad.—Cases have recently been brought to the attention of the Department of Overseas Trade (Development and Intelligence) by His Majesty's Trade Commissioners in which United Kingdom firms have broken off their relations with their agents abroad on the ground that, owing to preoccupation of war work or other difficulties, they are unable to deliver goods for export.

The difficulties experienced by manufacturers in maintaining their overseas trade are fully appreciated, but it is also well to bear in mind the position of overseas agents who find themselves unable to obtain their normal supplies of goods from the United Kingdom. It will not be disputed that a good agent is as valuable an asset to a manufacturer as any unit in his manufacturing organisation, and that the retention of his services may assist materially in keeping together the goodwill of the manufacturer's connection, even if orders from overseas cannot be executed. It may also be pointed out that the severing of connections with a good agent must necessarily lead to the agent seeking other principals, and so transferring his services and experience to a competitor.

The majority of British manufacturers have, no doubt, taken these facts into account, and instances have been brought to the attention of the Department in which the manufacturer has arranged to pay his agent a sum based on the commissions earned by him in more normal times. There have, however, been cases in which it has appeared that the position of the agent cut off from his normal supplies is not always fully realised, and it therefore seems worth while to call attention to representations made more than once by Trade Commissioners that a manufacturer who is unable to execute orders from abroad owing to war conditions should give serious consideration to the desirability of taking special steps to retain the services of a good agent, whether by the payment of a retaining fee or in some other way.—*Board of Trade Journal.*

Foreign Trade Department.—The address of this Government Department is now Bridgewater House, Cleveland Square, St. James', S.W. 1.

Royal Visit to Electrical Works.—In the course of the industrial tour of the King and Queen, last week, their Majesties visited the works of the Phœnix Dynamo Manufacturing Co., Ltd., at Bradford.

Trade Announcements.—Messrs. Fyfe, Wilson & Co. have removed to 133, West Campbell Street, Glasgow.

The "Sentinel" Wagon Works, Ltd., Shrewsbury, have taken over the Sentinel Wagon Works, and all the steam wagon business lately belonging to Messrs. Alley & MacLellan, Ltd. The new company will deal with all accounts in connection with the sale and manufacture of the "Sentinel" steam wagons, their parts and accessories.

The "Z" Electric Lamp Manufacturing Co., Ltd., announce that Messrs. Andrews & Co., of 40, West Campbell Street, Glasgow, will act as their representatives in Scotland, their other arrangements having been cancelled, by mutual consent.

Book Notices.—"Income-Tax up to Date." By H. J. Gully, F.C.A. London : "Financial News." 9d.—This pamphlet crystallises all the regulations on the subject for the current income-tax year (1918-19), and gives a table showing the amount of tax payable on incomes between £131 and £200,000. The working of the Excess Profits Duty is fully explained.

"The Rockefeller Foundation." A review of its work in 1917. By G. E. Vincent. New York : From the Foundation.

"Labour Difficulties and Suggested Solutions." By W. J. Deeley. viii + 175 pp. Manchester : Sherratt & Hughes. Price 7s. 6d. net.

"*Journal* of the Röntgen Society." Vol. XIV, No. 55. April, 1918. London : Percy Lund, Humphries & Co., Ltd. Price 4s. net.

"*Proceedings* of the Physical Society of London." Vol. XXX, Part 111. April 15th, 1918. London : Fleetway Press, Ltd. Price 4s. net.

Exports from Canada.—The Export Association of Canada, Ltd., of 62-65, Charing Cross Road, S.W. 1, which includes in its membership prominent manufacturing houses in Canada, is placing before British manufacturers and merchants inquiry forms and other documents on which they may furnish particulars of goods, &c., of which they are in urgent need, in case these can be secured from Canada as shipping facilities permit.

Plant for Sale.—Belfast Corporation Electricity Department has a quantity of surplus plant for disposal, consisting of one 1,000-KW. and two 200-KW. steam dynamos, two surface condensers, one air pump, four steel cooling towers, four 22-H.P. electric motors, &c. Particulars are given in our advertisement pages to-day.

Lists.—Messrs. Ward & Goldstone, Sampson Works, Salford.—Supplementary price list (No. 104) arranging very compactly in 36 pages illustrated particulars and prices of a great variety of electrical supplies, including cables, flexible cords, ironclad switch fuse and plug carrier, water-tight fittings, insulators, dry batteries, electric bell material, and general electric lighting and power accessories.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 4,171A (20 pages) containing a very full account, with excellent line and half-tone illustrations of their motor-operated oil break switches.

British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C. 4.—Price list No. 10,482, describing their flood-light projectors for use with standard half-watt type lamps.

LIGHTING AND POWER NOTES.

Aldeburgh.—Revision of Public Lighting Charges.—The Electric Supply Co. has asked the T.C., at the expiration of the present lighting contract next year, to enter into a fresh contract increasing the maximum price 33½ per cent. ; lamps when relighted to be charged £2 2s. each instead of £1 17s. 3d. A Committee is to consider the matter.

Altrincham.—Price Increase.—The Electric Supply Co., Ltd., has increased the price of energy for the June quarter for lighting by ½d. per unit.

Birmingham.—Year's Working.—The accounts for the year of the Electric-Supply Committee show a balance of £64,763, of which £39,500 has been carried to renewals and special expenditure account. It is proposed to place the surplus of £25,263 to the relief of the rates.

The number of units sold during the year totalled 160 millions, as compared with 149½ millions the previous year ; the increase of 10,550,763 units is almost entirely confined to high-tension supplies.

Blackburn.—Year's Working.—The annual reports of the Corporation electricity department for the year ended March 25th last show total income, £68,379 ; expenditure, £44,765 ; gross profit, £23,614 ; interest and sinking fund, £19,142 ; leaving a net profit of £4,472, as against £2,199 net profit in the previous year ; the total units generated during the year were 10,318.417, an increase of 1,481,204 units, or 16·76 per cent. on the previous year. Private lighting shows a decrease of 45,146 units and power (excluding traction) an increase of 1,784,883 units. Mr. Wheelwright, the borough electrical engineer, in his report states that the percentage of ash and clinker at times reached a figure of 30 per cent., while it has averaged throughout the year 21 per cent., or nearly double the amount in pre-war days ; owing to the fact that the plant at the generating station is practically fully loaded, it has been impossible to consider applications for large amounts of power except in cases of firms engaged on work where the Government would grant priority permits for obtaining the necessary material. The engineer emphasises the importance of the erection of a new generating station, and urges the Corporation to make strong representations to the Government on the matter.

Blackpool.—War Bonus.—An application for a war bonus of 20s. per week and 12½ per cent. on total earnings of the clerical staff of the Corporation electricity works has been refused by the War Bonus Sub-Committee. The Committee has also declined to entertain a request from the Municipal Employés' Association that the meter readers in the electricity department should be paid "all arrears," and that the full bonus of 16s. in future—instead of 14s.—be paid to them, together with 12½ per cent. on earnings, as from October 13th last.

Canada.—It is reported that 1,000 men are working on the Chippewa power development scheme, designed to furnish an additional 300,000 H.P. for the Ontario Hydro-Electric Commission.

Chile.—Hydro-Electric Power.—According to the *Board of Trade Journal*, a prolonged study has recently been made by an American hydro-electric engineer into the available water power in the South of Chile, and it appears that hopes of obtaining good results are held. Concessions, it is understood, have already been secured for some 60,000 H.P., a further 15,000 H.P. being in view. It is expected that about 40,000 H.P. may be taken by a copper company, while other probable consumers are a cement company and the local electric light and traction companies.

Coatbridge.—Fire.—On Friday, last week, a fire, which did damage estimated at £1,000, occurred at the offices of the Electric Supply Works, Dundyvan Road. The fire brigade succeeded in saving the works.

Colchester.—Year's Working.—The report of the year's working of the Corporation Electricity Department shows total revenue £23,420, works costs £17,002, gross profit £6,417. After payment of £6,467 for interest and sinking-fund charges there is a deficit on the year's working of £49. Had it been possible to make the additional charge of 10 per cent. from October 1st there would have been a profit on the year's working. the increase only taking effect in the last quarter of the year. Number of units sold, 2,008,826, an increase of 134,922 units maximum demand, 1,048 KW. ; load factor, 21·8 per cent. ; total amount borrowed, £89,814 : amount repaid, £42,904.

Continental.—Spain.—A concession has recently been granted for the establishment of a plant to utilise the water power of the River Turio, near Chinchilla, for the generation of electrical energy for lighting and power purposes.

Turkey.—It is announced from Constantinople that a company has lately been formed to establish a central electricity station at Caraman, in the Vilayet of Konia, for the supply of electricity for lighting and power purposes in the district.

Sweden.—The Harjeans Kraft Aktiebolag is the name of a new company which has lately been formed at Sveg, Sweden, with a maximum capital of £10,000, to establish a small electricity generating plant utilising certain water power available in the district.

Norway.—A conference was held, on Monday last, to discuss the question of the transmission of hydroelectric power between the Scandinavian countries ; it is believed that Scandinavia commands sufficient water-power to supply all the energy required for lighting and power and partly for heating.

Dublin.—Coal Supply.—At the Corporation's meeting on Monday last, the Electricity Supply Committee intimated that the Irish Director of Cross-Channel Transport (Mr. Burgess) proposed that for this year the coal supply to the electricity works should be only from 18,000 to 19,000 tons, or about 75 per cent. of last year's supply, and that this would mean a reduction in electricity output of from 43 to 44 per cent. It was decided to communicate with the Controllers of Coal and Shipping as to the dangerous shortage of coal reserves. It was also stated that under the best conditions a substantial reduction in supply of energy to consumers would become absolutely necessary, and that the Committee proposed a reduction to two-thirds of last year's supply at ordinary rates, charging for anything over that a price that would amount to a heavy penalty, but for the Committee's action in the matter of coal reserves it would have been necessary to have closed down on Saturday last. It was said that the Belfast Corporation had a coal supply that would last up to March next. There was no definite complaint of shortage except from Dublin.

The Irish Local Government Board has appointed Mr. P. C. Cowan, Chief Engineering Inspector, to hold an inquiry into the Corporation's application for a loan of £175,000 for the extension of the electricity undertaking and the works connected with it.

Faversham.—Price Increase.—The T.C. has decided to increase the price of energy for lighting from 6d. to 6½d. per unit to consumers of between 125 and 250 units per quarter, and from 5½d. to 6d. to those using over 250 ; and to charge a flat rate of 3d. per unit to power users, as from July. An overhead cable is to be run to the front pumping station, at a cost of £45, the Ministry of Food contributing £30 towards the installation expenses.

Glasgow.—Proposed Extensions.—On a report by the chief engineer that it would be necessary to build a sub-station at Linthouse for transforming electric energy at that point, the Sub-Committee of the T.C.'s Committee on Electricity has permitted the convener and engineer to make inquiry and purchase available ground.

Halifax.—The Tramways and Electricity Committee having been informed that the Ministry of Munitions cannot sanction the purchase of a new boiler for the electricity works, has decided to make an emphatic protest, and to state that it could not be held responsible should the electricity supply have to be curtailed through lack of steam at any time owing to the necessary boiler plant being unobtainable. Such plant is all the more necessary owing to the present unsatisfactory supply of coal, which is of very inferior quality.

Hebden Bridge.—Price Revision.—The Electricity Committee has decided that from July 1st no special rate will be allowed where the consumption of energy exceeds 100,000 units.

Lanark.—At the new hosiery factory hydro-electric power generated by the River Mouse is used for driving, and also for lighting, heating, and cooking the employés' meals.

Leek.—Price Increase.—The Electricity Committee has decided that for the next half-year the charges for electricity be as follows :—A flat rate of 5d. per unit plus 40 per cent., subject to a minimum charge of 15s. per half-year, for lighting. For power, for a consumption of under 2,000 units per half-year. 2d. per unit ; over 2,000, and under 4,000, 1¾d. ; over 4,000, and under 8,000, 1½d. ; over 8,000, 1¼d. Alternative power scale, £3 15s. per KW. demanded per half-year, plus ¼d. per unit consumed. For overtime supply, 3d. per unit. All charges for power to be subject to an increase of 50 per cent.

London.—Hammersmith.—Price Revision.—The Electricity Committee has had under consideration a report from the borough electrical engineer showing the effect on the revenue of the electricity undertaking for the current year of the recent wage awards, the increased price of coal, and the reduced consumption. On the statement of the engineer, the Committee finds it will be necessary to immediately increase the charges for electricity; proposals for carrying out the same will be submitted at the next meeting of the Council.—BOILER, &C., PLANT INSURANCE: The Committee recommends that the insurance of the boilers and other generating plant at the electricity works against damage by explosion be increased by 100 per cent.; the risk is at present £62,300 and the premium £757 18s. The additional premium will be £378 19s.—PLANT PURCHASE: Messrs. Gwynnes, Ltd., have made an offer to purchase the generators and motors supplied under the agreement for lighting and power for £3,500, subject to being supplied with electricity at a flat rate of 1d. per unit for both lighting and power. The rental charges included in the prices charged under the agreement were 1d. per unit for power and 3d. per unit for lighting. The Committee recommends the acceptance of the offer, the charge for energy to be plus any additional percentage charges as are at present in force or may hereafter from time to time be fixed by the Council.

PRICE REVISION.—The Charing Cross, West End, and City Electricity Supply Co., Ltd., has applied to the B. of T. for an Order to increase its maximum price for lighting purposes from 4d. and 5d. to 6d. per unit.

Nottingham.—YEAR'S WORKING.—Long-continued criticism regarding the obsolete character of the electrical generating plant is at last likely to bear useful fruit, it being announced at a meeting of the City Council on Monday by Mr. R. H. Swain, the new chairman of the Committee in succession to Sir John Turney, that schemes are in contemplation, involving an estimated expenditure of a quarter to half a million, which are designed to effect an entire upheaval of existing conditions. Obviously the work, which had been too long delayed in pre-war times, cannot be entered upon under present conditions, but the assurance is forthcoming that, with a return to normal times, there will be no further procrastination. The past year has been the most unfortunate in the history of the undertaking, which has failed to make a profit. The Committee reported that during the period 500 tons less coal had been consumed, and 216,174 more units generated at an increased cost of £4.876 for coal. The question of the provision of a new electric generating station had received careful consideration during the year. The city electrical engineer (Mr. H. Talbot), in his annual statement, mentioned that the total horse-power installed at the three generating stations was 17,030 H.P. The number of 32-watt lamps, or their equivalent, connected on March 31st was 589,159, an increase of 18,666 for the 12 months; 39 additional motors, aggregating 472 H.P., had been connected to the mains, making a total of 2.194 motors and 9,892 H.P. The number of units sold during the 12 months was:—For lighting, 3,221,768; for power, 4,899,595; and for traction 6,812,253, a total of 14,933,616 units, or an increase of 216,174. The total work costs last year were 1·50d.; in 1917, 1·35d.; and in 1916, 1·20d. The sum received from the sale of energy during the past year was £118,950. Loans have been repaid to the extent of £221,955, there being in the reserve fund £43,662. The Committee decided to increase the price charged for all electricity by a further 13⅓ per cent. upon present rates, making a total increase since the commencement of the war of 33⅓ per cent., to take effect from Lady Day.

Nuneaton.—LOAN SANCTION.—The T.C. has received sanction to a loan of £412 for expenditure on plant. Owing to a loss of £2,000 on the year's working, the T.C. is getting figures from other towns, with a view to revision of charges.

Rathmines.—WAGE DISPUTE.—The members of the Stationary Engine Drivers' and Firemen's Union agreed to submit the question of wage advances to arbitration; the decision of Mr. Whitaker, K.C., was against them, and the men have now notified the local Council that they will not be bound by the Arbitrator's award, and demand £1 per week advance on pre-war wages plus the 12½ per cent. bonus. The Council has refused the application, and has warned its customers and the public that the supply of electricity for public and private lighting might have to be discontinued.

Selby.—OVERHEAD LINES.—The R.D.C. has granted permission to the Yorkshire Electric Power Co. to extend its electricity supply to the Selby shipyards by means of an overhead cable passing through part of the Council's district.

South Africa.—DURBAN.—The 1917 report of the Corporation electricity undertaking shows a gross profit of £71,000, mpared with £61,000 in 1916 and £56,000 in 1915. The sum of £17,936, the same as for the previous year, was handed over for relief of rates. The total capital expenditure is £561,000, and the undertaking has altogether paid £213,000 to the relief of rates. The tariff, from ⅜d. to 5d. a unit, is the lowest in South Africa.

Stalybridge.—LOAN APPLICATION.—The Generating Station Committee of the Joint Tramways and Electricity Board has decided to make application to the Local Government Board for sanction to borrow the sum of £8,000 for electricity purposes.

Todmorden.—BULK SUPPLY.—In view of the large expenditure which would be involved in replacing plant in order to make the Corporation electricity works a paying undertaking, as had recently been proposed, the Electricity Committee, last week, decided to recommend the adoption of the alternative policy of taking a bulk supply from the Yorkshire Electric Power Co. on the basis of their Scale A charges. The Town Council, last week, approved the proposal, and decided to apply for sanction to borrow £5.500 for capital expenditure in connection with the erection of the necessary sub-station.

Yeovil.—The B. of T. has extended the 1914 E.L. Order for a year.

TRAMWAY AND RAILWAY NOTES.

Bath.—ACCIDENT.—While descending a hill near Weston, on Wednesday last week, a tramcar left the rails, dashed into the boundary wall of some houses, and overturned. One passenger was killed and over 20 injured, including several convalescent soldiers. The woman driver and conductor were only slightly hurt.

Birmingham.—YEAR'S WORKING.—There is a credit balance on the year's working of the Corporation tramways of £101,000; £63,898 is carried to reserve, £12,801 to the credit of motor-'bus suspense account, and £25,000 to the credit of the borough fund. The traffic receipts—a record—exceeded £1,000,000 sterling.

Blackburn.—YEAR'S WORKING.—In his report on the year's working of the Corporation tramways, Mr. J. H. Cowell, the general manager, shows traffic receipts of £77,658, and parcels £2,207, a total of £80,361. Working expenses were £53,231, leaving a balance of £27,129, as compared with £17,277. Interest and sinking fund charges were £20,892, as against £20,018 the previous year, and the net result is a profit balance of £6,970, compared with a loss of £2,439 last year. The mileage increased by 3,798 miles, passengers by 596,444, and revenue by £14,340; the miles run were 1,055,876, the passengers numbered 12,458,787, and the receipts per car-mile were 17·65d. Mr. Cowell pointed out that the £6,970 was not actually profit, as it included £3,000 which, under ordinary circumstances, would have been expended on the permanent way during the year, whilst in consequence of revenue not meeting requirements, the expenditure on the permanent way last year fell short by £2,000. Dealing with the proposed restrictions, Mr. Cowell anticipates the car-mileage being reduced at least 10 per cent., which will mean heavily decreased receipts, whilst the wages account will be increased by £7,000 owing to the latest award of the Committee on Production. A further revision of fares is suggested.

Blackpool.—LABOUR SHORTAGE.—The Tramways Committee has decided to ask the War Office for the services of 50 men from a Labour Battalion to be placed at the disposal of the Corporation for the purpose of carrying out much-needed repairs to the tramway permanent way in the borough.

Bolton.—BONUS APPLICATION.—The Tramways Committee has received an application from the National Transport Workers' Federation for a 12½ per cent. increase on existing total earnings of all employés, or for an increase on the standard rate equivalent to it, with equal payment for both women and men, both in war bonus and on basic rates. At present the women receive 14s. 1d. war bonus, as against the men's £1 1s. 8d., but in other respects they are paid the same rate as the men. The application was not acceded to, and was referred to the Committee on Production. If granted, the increase would mean 7s. a week for motormen, 6s. 6d. for male conductors, and 14s. per week for women conductors. Stalybridge, Hyde, Mossley and Dukinfield Tramways Board, which has had a similar application, has passed no resolution on the matter. Accrington Electricity and Tramways Committee is strongly opposed to the granting of the bonus.

Bradford.—INCREASED FARES.—The increased fares came into operation on Saturday last. There is no alteration in fares for children up to 16 years of age, but, generally speaking, the increase is 50 per cent.; in a few cases it is higher, and the early morning fare is doubled.

The tramway manager (Mr. C. J. Spencer) has urged the local Trades Unions to endeavour to arrange work hours so that employés of all firms will not be crowding on the cars at the same time. He has also issued an appeal to ladies to finish their shopping in the quieter hours. The Trades and Labour Council has approved the appeal, and has referred the matter to a Joint Advisory Committee of the Council and the Chamber of Commerce.

Canada.—REJECTED WAGE INCREASES.—The Montreal street railway employés have rejected wage increases offered by the company. Motormen and conductors with more than five years' service were offered 37 cents (1s. 6½d.) an hour (a 25 per cent. increase); under five years' service, 30 cents. The men demand a minimum of 40 cents.

Continental.—FRANCE.—It is reported that the engineers of the Paris, Lyons, Mediterranean Railway Co. are preparing plans for the electrification of the line between Alais and Clermont. Water power is to be utilised to generate the necessary electrical energy, a large barrage at Pont de Montvert being contemplated.

Glasgow.—The manager of the T.C. tramway undertaking has recommended, and the Committee has approved, that the following sums be set aside for depreciation for the year ending May 31st next:—Permanent way £78,511; power station and sub-station plant, £13,915; cars and electrical equipment of cars, £27,923; other rolling stock, £2,830; Clydebank bridges, £550; total, £123,729.

Traffic Returns.—As was indicated in recent issues of the Review, a series of records has again been established by the Glasgow T.C. Tramway Department. The official figures for the departmental year, which closed on May 31st, give the following traffic statistics:—Car-mileage, 26,261,231 miles, an increase of 475,184 miles; traffic receipts, £1,404,110, an increase of £158,602; traffic receipts per car-mile, 12·832d., an increase of 1·240d.; the passengers carried numbered 430,946,566, an increase of 42,651,690. So far as fares are concerned, a feature was the extraordinary boom in halfpenny tickets. These increased at an average of almost half a million a week throughout the year.

Halifax.—Service Reduction.—A Special Sub-Committee recommends, in order to comply with the Board of Trade request for further economy in fuel and man power on tramway undertakings, that the existing stopping places of the local cars be reduced by 30 per cent.; the running of fewer cars in the quieter hours of the day; the discontinuance of late night cars; and the commencement of Sunday service at 2 p.m. instead of 1 o'clock. Joint efforts are being made locally to arrange varying times of industrial working hours, to avoid the crush for cars at particular times.

Huddersfield.—Traffic Congestion.—A conference of representatives of the Corporation Tramways Committee, Huddersfield employers, and various industrial Trade Unions of the district was held last week to consider means of diffusing traffic by the alteration of mill hours, so as to avoid the rushes for cars at certain times of the day. It was arranged that some scheme of varying the times of starting and finishing work in different trades, or on some such lines, should be drawn up for further consideration, particularly as between employers and workpeople of the industries.

Leeds.—Fare Revision.—The new scheme of increased tramway fares adopted by the City Council in May has been found impracticable, and the Tramways Committee, meeting last week, decided to recommend the total abolition of halfpenny fares (the original proposition). It has been found that much hardship is caused by the abolition of overlapping fares in the centre of the city.

Parcel-carrying Scheme.—The parcel-carrying scheme on the Leeds tramways, recently established, but hitherto limited to a small portion of the system, is now extended to practically the whole system, and agents have been appointed on all routes. As further special cars for parcel traffic cannot be constructed at present, the ordinary service will be utilised.

Liverpool.—Fare Revision.—Mr. Mallins, manager of the Corporation tramways, has presented a report to the Tramways Committee on the question of the revision of tramway stages and fares. He suggests adopting a penny stage based upon an equal length for all routes—say two miles. To prevent inconvenience by the shortening of the penny stages, he suggests the introduction of a 1½d. stage. The expenditure on the tramways this year is estimated at about £130,000 more than last year, and if the suggested revision takes place there will be an increased revenue of £88,414 a year.

London.—According to the *Daily Mail*, as a means of saving power and coal, the North London Railway Co.'s electric trains are all to travel at a slower speed, and the time taken on all journeys will consequently be longer.

Fare Increase.—On Saturday the fares on the Northern tramway systems of the L.C.C. will be advanced into line with those on the South side of the river. Children's tickets and all odd halfpennies in fares will be abolished, the 1½d. stage going up to 2d., 2½d. to 3d., and so on. There is no intention at the moment to interfere with workmen's fares, but these will also be advanced later on.

Potteries.—Fare Revision.—The Potteries Electric Traction Co., Ltd., has decided that on and after June 1st, 1918, all ordinary fares up to and including 2d. will be increased by ½d., and fares above that amount by 1d. A 1d. fare will be available over any single section of a route. Workpeople's and scholars' weekly tickets will still be on the basis of half the ordinary fares.

Preston.—Year's Working.—At a meeting of the T.C. the chairman of the Tramways Committee stated that during the year ending March 31st, 16½ million passengers were carried, an increase of nearly 1¾ millions. The total income was £63,498, as against £57,776. Working expenses were £43,493, as against £36,029, the total amount paid in war bonuses being £5,880. On the present basis the annual charge under this heading would be approximately £11,000. The reserve fund was £52,231, as against £50,061, and the total debt outstanding was £129,389. It was not proposed at present to increase the ordinary fares, though that might be necessary in the near future, but it had been decided to abolish the present workmen's fares, which gave four miles' travel for 1d., or eight miles for 1½d., and to substitute new rates on the basis of a single fare for the double journey, thus complying strictly with the Parliamentary schedule for workmen's fares. The Sunday morning cars were to be discontinued, the late evening service curtailed, and the number of "request stops" reduced, in compliance with the Board of Trade Tramway Committee's recommendations.

South Africa.—Durban.—Accounts of the Corporation tramways last year show a gross profit of £59,696, compared with £55,828 in 1916. The total revenue was £159,254. The total capital expenditure on the undertaking was £591,991, whilst the outstanding loan debt was £510,000, and since its inception in 1899 the department has not only spent in extensions, renewals, and replacement of plant, out of revenue, £147,665, but has repaid loans amounting to £6,463, and accumulated in cash—sinking funds, £61,727; renewals fund, £16,448; accident insurance fund, £12,017; and has handed over to the borough fund for the relief of rates the total sum of £197,368. The tramcar fares in Durban are the lowest in South Africa, being an average of ·67d. per mile, based on cash fares.

Warrington.—Year's Working.—The annual report of the Corporation tramways for the year ending March 31st shows receipts £32,697 and expenditure £22,465. The net profit was £4,503, which is carried to the appropriation account, making a disposable balance of £6,021, of which £3,000 is reserved for the relief of rates. The reserve fund has £10,000 standing to its credit.

TELEGRAPH AND TELEPHONE NOTES.

China.—A considerable demand for telephone equipment has arisen at both Mukden and Changchung. A fair share of the trade will never be obtained without personal representation. The manager of the local telephone company states that he is in a position to buy $50,000 worth of telephone material, but that he will only do so after conferring with an actual representative of some manufacturing firm. A large order obtained here would probably mean further business, not only with the same company, but in other places in Manchuria. There are numerous small telephone systems in the district, mainly owned by native merchants, and equipped with Japanese instruments.—*U.S. Commerce Reports.*

South Africa.—Durban possesses its own telephones, the only municipal system in South Africa, and its tariff is approximately 50 per cent. below the Government charges. Last year the gross profit was £17,631, and £5,400 was paid over to the rates. The sum total paid in rate relief now amounts to £37,743. The capital of the undertaking is £149,769.

United States.—A strike in the Western Union Telegraph Co., affecting 30,000 operators, is expected. The Western Union refused to follow the recommendation of the Labour Board, permitting operators to form a Trade Union. Mr. Gompers will, it is expected, appeal to President Wilson to intervene.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—July 3rd. Victorian Railway Commissioners. 21 electric meters for power circuits. Specification may be consulted at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

Belfast.—June 7th. Electricity Department. 9,000 yd. of 6-core 0·1 sq. in. lead-covered, paper-insulated cable, and laying. See "Official Notices" May 24th.

Lancaster.—July 16th. Electricity Committee. 6, 9, and 12 months' supply of slack or nuts (screened and washed). Mr. J. B. Patterson, Electricity Works, Marton Street.

London.—St. Pancras.—June 10th. Electricity Committee. 12 months' supply of steam coal. Electricity Department, 57, Pratt Street, Camden Town, N.W.

Newcastle-under-Lyme.—Electricity Department. One 150-kw. rotary or motor-converter set and switchgear. See "Official Notices" May 24th.

Spain.—Tenders have just been invited by the municipal authorities of Astorga (Province of Leon) for the concession for the electric lighting of the town during a period of 15 years.

Warrington.—June 18th. Electricity and Tramways Committee. High-tension lead-covered cable and medium-tension rubber-covered cable. See "Official Notices" May 31st.

CLOSED.

Hammersmith.—The Electricity Committee has granted Messrs. Cory Bros. & Co., Ltd., an increase of 15 per cent. in their charges for lighterage and demurrage for coal for the electricity station, equivalent to 3½d. per ton on the coal supplied, the increased charge being in consequence of the recent wages awards of the Committee on Production.

Johannesburg.—Reporting on tenders for the supply of trolley wire the tramway manager stated :—

> The reason further tenders have been called for is that although 5 miles of this wire has been on order from the Telegraph Manufacturing Co., since April, 1916, we have been definitely informed by them that there is no hope of delivery. Therefore, their further tender cannot be considered.
>
> The position with regard to trolley wire is now getting serious, and no doubt the Committee is aware of the trolley wire snapping in various places in the town, causing irritation to the public and stoppage of the trams. I think it resolves itself into a question of policy on the part of the Committee, as to whether it will make certain of a supply.

Two of the tenderers notified that trolley wire had been shipped : the Griffin Engineering Co., and Messrs. H. Davis & Co.

> As far as I am able to judge, says the manager, there is no certainty attaching to any of the other tenders, either from Japan or America. compared with the certainty of trolley wire actually having been shipped on the steamships mentioned in the case of Messrs. Davis & Co., and of the Griffin Engineering Co. Therefore, the Tramway and Lighting Committee is called upon to decide as to whether it will make certain of a supply in accordance with the tenders of Messrs. Davis and the Griffin Co., or place itself in the same position in future as obtains to-day—that is, placing orders without any certainty of getting supply.

The Council has accepted the tenders of Messrs. Davis & Co., for a total of 8,960 lb. (approximately 4 miles), at a total cost of £1,013, and the Griffin Engineering Co., for 10 miles of trolley wire, at a total cost of £2.750.

The T.C. has accepted the tender of the South African General Electric Co., for the supply of 10,000 yd. of 1 sq. in. cable, for £16,700.

As to British tenders the Committee reported :—"The difficulty of the position in reporting on British tenders is that no definite information is obtainable, and, generally speaking, one can take it for granted that there is no hope of getting copper cable from England."

Salford.—Electricity Committee. Tenders accepted :—

Four 1,666-K.V.A. transformers.—British Westinghouse E. & M. Co., Ltd., £5,460.
Glazed stoneware pipes.—Doulton & Co., £661.

York.—Electricity Committee :—

Babcock & Wilcox, Ltd.—Coal elevating plant to replace obsolete existing machinery, £1,797, plus cost of alteration and erection.

FORTHCOMING EVENTS.

Institution of Mining Engineers.—Thursday, June 13th. At 11 a.m. Annual general meeting; and on Friday, June 14th. At 10 a.m. At Burlington House, Piccadilly, W. 1.

Junior Institution of Engineers.—Friday, June 14th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Electric Accumulators," by Mr. R. Rankin.

North-Eastern Section.—Tuesday, June 11th. At 7.15 p.m. At the Mining Institute, Neville Street, Newcastle-on-Tyne. Paper on "The Applications of the Static Transformer," by Mr. S. A. Stigant.

NOTES.

How to become a Wireless Engineer.—The *Wireless World* for May contains an interesting article on this subject, intended to constitute a reply to the many inquiries received by the editor. It is stated, with reference to the practice of the Marconi Co., that great importance is attached to the character and general education of the would-be engineer, who must also have been thoroughly trained in general engineering, be from 21 to 25 years of age, and be physically fit. The range of subjects covered in his technical training has to be a very wide one, and both college and workshop training is essential.

Hull Technical College.—Hull Education Committee considered a request from the Electrical Contractors' Association (Incorporated) East Riding Branch, that they might send a representative to act on the Technical Committee of the Education Authority at Hull. The Director stated that no doubt the Committee referred to was the Advisory Committee for the Engineering, Shipbuilding, and Allied Trades. The Committee decided that the Association should be informed that their request would be favourably considered when the Advisory Committee resumed its operations.

The University of Toulouse.—A detailed description of the curriculum and equipment of the Institute of Applied Electrotechnics and Mechanics at the University of Toulouse is given in *Le Génie Civil* for April 27th. The Institute provides a thorough course of training in electrical engineering and applied mechanics, which lasts three (and in some cases four) years. The laboratories, which are equipped in an up-to-date manner, provide both for teaching and research. Special attention is given to hydraulic and internal-combustion engineering. Separate sections are devoted to technical measurements on electrical machines and accessories, static electricity and magnetic measurements, photometry, wireless telegraphy, &c. A special water tower and auxiliary plant is installed for experiments on water pressure and flow—an innovation that will prove of great value in view of the proposed extension of hydro-electric power in different parts of France.

The Employers' Parliamentary Council and the Trade Boards Bill.—The above Council has issued a Memorandum on this Bill, which gives powers to the Minister of Labour to establish Wages Boards for the fixing compulsorily of rates of wages which employers may legally pay. The Bill is an extension of the Trade Boards Act (1909), which was restricted to what were called "sweated industries," and is regarded as an attempt to fix permanently the inflated wages and artificial conditions of employment prevailing during the war. Under the principal Act, extensions could be made only by Provisional Order confirmed by Parliament, thus securing to all opponents the right of being fully heard. The present Bill transfers powers from the Board of Trade to an individual Minister, practically removes the safeguards given by the principal Act, deprives opponents of the right to be heard by Parliament against an Order, and places them at the mercy of a State Department without any power of resistance. The Employers' Parliamentary Council state that it is not aware of any reason for departure from the present course of procedure, and, therefore, urges the retention of the safeguards now existing, and submits that such a Bill should not be promoted in anticipation of the proceedings of Joint Standing Industrial Councils to be established in the several industries, among the essential functions of which will be the fixing of rates of wages to correspond with the demand for "a higher standard of comfort generally" ; and it further submits that to give general powers to a State Department to trespass upon the legitimate province of these bodies, which would possess a practical knowledge of the facts and circumstances relating to the industries they represent, is unwise and harmful, and likely to be strongly resented by the Joint Councils, who will naturally be jealous of their own authority and powers. The Employers' Parliamentary Council holds that if these Joint Councils cannot be trusted harmoniously to settle such a fundamental matter as the fixing of the rate of wages without their arrangements being subject to the decisions of a Statutory Wages Board, set up possibly at the instigation of a small number of discontented persons, their prestige will be destroyed, and the scope of their operations will necessarily be seriously diminished.

Electric Cabs at the Hague.—Owing to the scarcity of petrol, a service of electric motor-cabs is about to be started at the Hague.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, VOLUNTEER ENGINEERS.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending June 15th, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Darley Bentley.
Next for Duty.—Capt. E. G. Fleming.
Monday, June 10th, to Friday, June 14th.—Drills as usual.
Saturday, June 15th.—Commandant's Parade at Headquarters, 2.30 p.m., for drill in Hyde Park. Dress: Drill order with rifles.

C. HIGGINS, *Capt.* R.E., *Adjutant.*

Storage of Coal.—An article by S. W. Parr on "Some Developments in the Chemical Industries as a Result of War Conditions," in *Science* of April 26th, contains much interesting information ; with reference to the storage of coal on a large scale the author states that a number of chemists and engineers have been at work for a number of years on this problem, and results are now available in such a form as to furnish a practical contribution to this very important problem. The summary of it all seems to be : First, that coal can be stored in large masses with a fair degree of safety from spontaneous combustion ; and secondly, that the loss of heat values due to weathering or other deterioration processes is practically negligible. As confirmatory, at least, of the first of these conclusions, the case is cited of a large power and lighting concern in the U.S.A. which for some time had been putting in practice the principles involved in the proper storage of coal, and, indeed, had a very considerable stock in hand. During the recent freight embargo due to weather conditions, this company was able to continue its service without interruption by drawing upon its reserve supplies. Only an occasional truck-load of coal was received for 30 days, and what this meant to the operating end of the system may be realised when it is known that the fuel demand of the concern's boilers amounted to between 6,000 and 7,000 tons per day. There was a storage supply that was drawn upon to the extent of over 200,000 tons. The practicability of storing coals was thus strikingly demonstrated. The chemists have worked out the fundamental principles involved ; it is now up to the engineers to apply them. The storage of coal having been shown to be possible, it at once becomes an industrial as well as a war measure of very great importance.

Electrical Equipment of German Aeroplanes.—Lieut. J. L. Lefranc, who described a short time ago in *La Nature* the principal types of German aeroplanes and their engines, gives in a recent number of the same journal some highly interesting particulars of the armament of these machines. With regard to the electrical equipment, he says the wireless plant comprises a generator driven by a small air screw or by the engine, a transmitter, and an aerial. A special device permits of varying the wave length and intensity of emission. The range of the set is about 30 km. (18·6 miles). Some machines are also equipped with receiving apparatus as well.

For heating purposes the German machines are equipped with electric heaters fed by the wireless generator or by a special generator. Special heating devices are also provided for keeping fluid the lubricating oils for the engine and for the machine guns when machines are flying at a great altitude. The position indicators, instrument lamps, landing signals, &c., are generally supplied by a small generator or from accumulators.

Cheap Road Transport.—A luncheon meeting of the Commercial Motor Users' Association, last Friday, was made the occasion for the inauguration of Colonel R. E. B. Crompton, C.B., as the first President of the Association. Colonel Crompton delivered his presidential address on "The Future of Heavy Motor Traffic." After dealing with gas propulsion, he said it was practically certain that further developments of accumulators would take place in the near future, which would increase their usefulness and durability, and reduce the deadweight carried.—*The Times.*

Institution and Lecture Notes.—Illuminating Engineering Society.—The report of the Council for the past session states that the Joint Committee under the Department of Scientific and Industrial Research has been continuing its work, one matter that has received special consideration being the important question of illuminating glassware.

Further work has been done by the two Committees engaged in experiments on flares and parachute lights and on luminous gunsights for a Government Department, and interim reports on both subjects have been presented. In addition, suggestions have been submitted for the consideration of the authorities with regard to such matters as economy in lighting in relation to fuel saving, lighting arrangements for air-raid shelters, and the desirability of obtaining fuller statistics on the effect of inadequate illumination in causing street accidents. Through its representatives the Society has been participating in the work of the London Safety First Council, especially the bearing of illumination on street safety.

The Society has also been considering the best means of furthering investigations on the hygienic and physiological aspects of illumination.

With the commencement of the present year "The Illuminating Engineer," the official organ of the Society, attained its tenth anniversary, and the event was celebrated by the issue of a special number of the journal, in which the progress of the illuminating engineering movement since its inception was surveyed. A large number of messages of congratulation were published, illustrating the wide interest now taken in the work of the Society, as a body of national value, with great possibilities of future development.

Fatalities.—At the residence of Mr. J. E. Tully, Hexham, his head gardener (Mr. William Bolton) was killed while attending to his duties in the greenhouse. It seems that Mr. Bolton was tying a plant to a galvanised wire, which was in contact with the electric light cable. Deceased called to the under-gardener, who at once pulled him off, receiving a shock in doing so. Dr. J. A. Jackson was speedily called in, but pronounced life extinct. The deceased was 42 years of age.

British Engineering Standards Association.—The Engineering Standards Committee, as reported in our last issue, under "New Companies," has now become incorporated under the Companies' Acts, the word "limited" being omitted by licence of the Board of Trade. The Committee, therefore, is now a corporate body with a legal entity, and is thus enabled to maintain its position with regard to its brand, which has been largely used in a number of the British standard specifications. The wider use of the brand by manufacturers generally who are working to the British standards should be of material advantage to the British engineering industry throughout the world. The good work that the Committee has done during the past 17 years, and its acknowledged position in the engineering world, make its incorporation a logical sequence in its development.

Appointments Vacant.—Professor of electrical engineering (£600, with quarters): two lecturers in civil and mechanical engineering (£400, with quarters), for the Hong-Hong University: chief clerk for the Tunbridge Wells Corporation electricity works; station superintendent (£195 + $12\frac{1}{2}$ per cent.) for the Eastbourne Corporation electricity works: junior switchboard attendant (29s. 6d. + 9s.) for the Rhondda U.D.C. electricity department: charge engineer (70s.) for the Wakefield Corporation electricity department; engineer-in-charge (£140 + $12\frac{1}{2}$ per cent.) for the Hereford Corporation electricity works. See our advertisement pages to-day.

Linking-up in South Wales.—Whilst going to press, we have received from the hon. secretary of the Local Committee for the Linking-up of South Wales and Monmouthshire Electricity Supply Undertakings a copy of the Committee's Interim Report. The area concerned has been divided into three areas, in each of which the question of linking-up is being considered in detail.

Chief Technical Assistants' Association.—The annual social of the Association was held on Saturday last at Anderton's Hotel, Fleet Street, E.C., Mr. H. F. J. Thompson (Battersea), the chairman of the Association, presiding. The chairman said that the membership, although limited to senior technical officers, was steadily growing, and the extension of the Association to the United Kingdom had produced very gratifying results; it was anticipated that very soon a number of additional local centres would be formed in the provinces in order that country members would have the same advantages as their colleagues in London. It was not intended to be only a technical society, it had also protective objects, and engineers in electricity supply and traction undertakings, both company and municipal, who were eligible and not yet attached to any other similar society, should communicate with the hon. sec., Mr. A. P. MacAlister, 50, Eden Grove, N. 7. He hoped that the day was not far distant when, as regards the protective measures, all such Associations would join forces; but they would continue to hold their usual meetings on technical subjects.

Mr. A. P. MacAlister, honorary secretary, outlined the proposed Association of British Engineers, and hoped that all members would give it their consideration.

Electricity in Oilfield Development.—A paper on "The Application of Electrical Power to Oilfield Requirements" was read at a meeting of the Institution of Petroleum Technologists, last week, by Mr. J. Wilfred Burford, A.M.I.E.E., who stated that electrical power was extensively used for drilling, cleaning out, and pumping oil wells in the United States, especially in California and West Virginia. In the United States there were now 1,750 applications of electric motors to oil wells, aggregating 38,000 H.P. In California 100 wells had been drilled by electric power, the deepest of which reached a depth of 2,700 ft., while in West Virginia one was taken down to 3,100 ft. Of the 11,000 wells in the Baku district 27 per cent. were operated electrically, necessitating generating plant amounting to 70,000 KW. Rumania had about 200 wells electrically operated, aggregating 14,000 H.P.—*Financier.*

Decimal Coinage.—On the motion for the second reading of the Decimal Coinage Bill in the House of Lords on Tuesday, Lord Leverhulme opposed it on the ground that the new coinage should be based not upon the sovereign but on the halfpenny. The Government was unable to support the Bill, but was willing to appoint a Joint Committee to deal with it. The debate was adjourned.

British Scientific Products Exhibition.—As already announced here, the British Science Guild is organising a comprehensive Exhibition of Products and Appliances of Scientific and Industrial Interest, which prior to the war were obtained chiefly from enemy countries, but are now produced in the United Kingdom.

The Exhibition, which will be held at King's College from about the first week in August until the first week in September, will show in the first place products chiefly imported from Germany before the war, but now made in this country; but it will also illustrate the remarkable developments that have taken place generally in our scientific industries. In many of these, as a matter of fact, Great Britain always excelled, and it is only our national quality of self-depreciation which has prevented the public from appreciating the fact that we were able to export to Germany apparatus and products embodying the highest scientific knowledge and technical skill.

The general scope of the Exhibition is set forth in a preliminary leaflet which has been issued, from which it is noted that the exhibits will include:—Chemical products; thermal, electrical, and optical appliances: glass, quartz, and refractory materials; photographic apparatus and material; surgical and medical appliances; and papers and textile products.

Further particulars may be obtained from the Organising Secretary, 82, Victoria Street, London, S.W. 1.

Tramway Crane.—In the *Electric Railway Journal* of April 20th, Mr. W. H. McAloney mentions a home-made motor-operated 3-ton crane for use in the engineering department, which the Denver Tramway Co. recently turned out in its shops. The car operates very successfully, and is proving to be a big labour saver. It was recently used to advantage in handling sections of special work and temporary track made up ready for use during replacement of the special work lay-out crossing.

The car is 40 ft. long overall, 8 ft. wide, and weighs complete 53,000 lb. It is equipped with two Brill 27-E trucks and four GE-58, $37\frac{1}{2}$-H.P. motors, operated with a K-6 controller and auxiliary contactors. Tomlinson A1-2 couplers and Westinghouse semi-automatic air brakes are used. The car-operating cab is 15 in. above the floor, and has a receptacle on both front and back for a Golden Glow searchlight with a 94-watt lamp on main and dimmer resistance. The steel jib crane has a capacity of 3 tons and a reach of 21 ft.; the beam is 26 ft. 2 in. long, with the revolving axis 4 ft. 8 in. from one end, and stands 7 ft. 4 in. above the car floor. The crane is motor-operated, the platform being supported at the base of the drum by two 6-in. channels on the outside, and two beams of the same size channel placed back to back lengthwise in the centre of the platform and cross braced with angles. The floor of the platform is made of $\frac{1}{4}$-in. steel plate. The distance from the bottom of the crane-motor platform to the car floor is 17 in. The motor, which is a 10-H.P. Otis Elevator, compound-wound, direct-current machine, handled by an old K-10 controller, is placed in a horizontal position, and power is transmitted through bevel gears to a vertical shaft with a pinion which engages a large band gear encircling the lower part of the drum.

Combined Fuel Rations.—According to the *Daily Mail*, the combined coal, gas, and electricity rationing order will come come into force for England, Scotland, and Wales on July 1st. People who then exceed their allowance will have to pay at greatly increased rates for the excess quantity, and will be liable to have their supply cut off.

Every household of from two to twenty rooms will be rationed on the basis of about $3\frac{1}{2}$ tons of coal a year for two rooms, with an extra ton for each additional room.

Of this allowance the consumer can take as much as he likes in gas (15,000 ft. for each ton of coal) or electricity (800 units for a ton of coal).

He will have to declare how he intends to apportion his year's ration in coal, gas, and electricity, and must keep to his figures.

An Electric Vehicle "Team" Attachment.—Recently there was introduced in the United States a three-wheel electric tractor unit, designed to replace a team of horses, while otherwise employing existing truck equipment. The tractor is propelled b the forward electric wheel, and is of a length about equal to a pair of horses. The speed is approximately 50 per cent. faster than that of a team when loaded, and about 100 per cent. when running empty. This model is expected to accomplish results ordinarily achieved by two teams and drivers. The plan is to use one tractor in connection with two wagons, no change being made in wagon construction other than to remove the tongue and the whippletree, and to substitute therefor a suitable connection which will enter into the coupling at either side of the electric tractor.

It is understood that a number of these electric tractor installations are working very satisfactorily in practice.

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

The National Executive of the Association met at Birmingham on the 1st inst. Representatives of the Northern, Midland, and Southern Divisions were present, with the hon. general secretary (Mr. W. Arthur Jones). Mr. H. W. Healy was elected chairman.

At the outset it was resolved, in view of the draft proposals of the West Yorkshire Section having been received too late for the detailed consideration of the Divisional Councils, that the meeting should consider only the general lines of the rules of the Association, and only by unanimous agreement of the National Executive should these be considered binding on the members of the Association: any controversial points not agreed upon to be submitted to all Divisions existing on June 1st, for reconsideration: the further recommendations of these Divisions are to be received by the honorary general secretary on July 6th, and to be submitted and finally decided upon at the adjourned National Executive meeting to be held at Manchester on July 27th, 1918. Meanwhile, the draft rules from all sections are to be collated by the Divisional Secretaries.

It was arranged to form a Junior Section, open to pupils, apprentices, and improvers.

The Ministry of Labour, in accordance with the terms of the Whitley Report, has summoned employers and Trade Unions connected with the electricity supply industry to meet at Manchester during June to discuss the formation of an Industrial Council, and it was decided to send representatives.

The following Objects of Association were unanimously agreed upon:—

1. To raise and maintain the efficiency and general status of engineers engaged in the electrical industry.

2. To act as a protective organisation on behalf of members of the Association.

3. To secure that only qualified engineers are appointed to responsible positions involving the management, direction, or control of engineering matters connected with the electrical engineering industry.

4. To secure legal certification of all qualified engineers.

5. To obtain recognition as a body of professional engineers and to ensure representation at all conferences affecting the interests of members of the Association.

6. To obtain for members the best possible conditions of employment and adequate remuneration, compatible with training, responsibility, and local conditions.

7. To ensure a maximum of six days a week of employment for all members engaged on shift duties.

8. To abolish the employment of pupils and apprentices in responsible positions, except in justifiable cases of sickness, emergency, or temporary relief.

9. To form an information and employment bureau for the general assistance of members and employers.

10. To provide legal assistance for members when necessary, so far as is allowed by law, in matters appertaining to their employment, and for securing compensation to members who suffer by accident or otherwise in their employment.

11. To promote educational and social intercourse amongst the members.

12. To uphold and maintain the absolute right of every member to determine from time to time the employer whom he shall serve.

13. To encourage and foster invention and discovery amongst members of the Association.

14. To promote the general advancement and efficiency of electric power supply and the conservation of the Empire's natural resources.

15. To encourage the members to contribute to the Electrical Trades Benevolent Institution.

The question of kindred Associations was discussed, and it was agreed that the E.P.E.A. desired the co-operation of all technical engineers engaged in the electrical industry.

It was decided to refer the question of divisional representation on the Council to all members of the Association. A vote is to be taken as to whether divisions shall be represented on the National Executive equally or proportionately to numerical strength.

The meeting adjourned until July 27th.

It will be noted with pleasure that the National Executive of the E.P.E.A., at the annual meeting reported above, while claiming in their objects of association some of the privileges of their profession, avowed their intention of also accepting some of its responsibilities. Among these, they have decided to support the Electrical Trades Benevolent Institution; their action should have far-reaching effects in making the fund better known throughout the United Kingdom and in recruiting a large number of subscribers from among staff men. We heartily commend the action of the E.P.E.A. to the notice of similar Associations, feeling sure that by following it they will be acting in the best interests of their members. Already the Hon. Publicity Secretary (Mr. G. C. Law) has forwarded to Mr. F. B. O. Hawes £8 8s., which the Association has raised for his fund by a concert, and also several subscriptions from members of the E.P.E.A. This is a very good beginning.

London and Southern Division.—Owing to the increasingly large number of engineers joining the E.P.E.A., it has been found advisable to form the Southern Division into sections, and the second of these was inaugurated at a meeting held at Stratford, Essex, on the 28th ult. It was there decided that the title should be the "Eastern Section," and that the Section should include members from electricity supply stations in East London. Mr. F. Farndon was elected chairman. The hon. secretary is Mr. A. J. Giffen, of 277, Shrewsbury Road, E. 7, with whom staff electrical engineers should communicate.

A general meeting of the members in the London Division will be held on Monday, 17th inst., at 7 p.m., at St. Bride's Institute, Fleet Street, when Mr. A. C. Bostel will give an address on "Trade Unions and Incorporated Societies." The chair will be taken by Mr. C. H. Wordingham, President I.E.E.

THE ASSOCIATION OF BRITISH ELECTRICAL ENGINEERS.

Electricity Supply Section.

On instructions from the Council of the Institution of Electrical Engineers, the Committee of the Newcastle Local Section convened a meeting of electrical supply engineers of all ranks, whether members of the Institution or not, to discuss the formation of the proposed Association with the title given above. Mr. Marshall (chairman) said that the Institution was debarred by its constitution from taking action of a political character, and had, therefore, devoted its attention more to academic than to economic affairs. In view, however, of the strong feeling which pervaded the country that electrical engineers had not the recognition and representation which they, as a useful professional body of men, deserved in the affairs of the country, the Council had decided to give all possible support to the formation of this Section of the Association, and other Sections at the earliest opportunity. The position as regarded electrical engineers, more particularly those connected with supply undertakings, was at present most unsatisfactory. In fact, some junior men had joined the workmen's Trade Unions for protection under Military Service Acts, and others had been forced into such Unions against their will by the action of their employers. The Whitley report distinctly declared that only the views of organised bodies would receive consideration, so that, unless professional electrical engineers had an association to speak for them, they would perforce have to have incidental representation either through the employers or through the manual workers.

Mr. L. L. Robinson (Hon. Secretary of the Supply Section) stated that the urgent need for the formation of an Association for the material and personal protection of professional or administrative electrical engineers appeared to be proved by the recent organisation of several such bodies, each of which was catering for the interests of a very limited section of their colleagues. Organisations existed for those who were contented to class themselves among the ranks of the operatives, in Trade Unions such as the E.T.U. But there remained a class of engineers who could not see their way to join operatives' Trade Unions, because, although they were technically employés, they were practically employers, or, at least, confidential agents of the employers of the operatives. In the electricity supply industry he classed in this category the chief engineer and manager of an undertaking and all his engineering assistants down to and including the engineers-in-charge and the assistant engineers-in-charge. This class of engineer had at present no representative body to look after his material, personal, and individual interests. As a consequence, the social status of these engineers had been unsatisfactory, the salary often ludicrously small, and the conditions of employment leaving much to be desired.

Some Associations of the classes of administrative officers referred to had been inaugurated. The chief objection to them was that they were small and not sufficiently influential. It had therefore been suggested that a new body should be formed to be called "The Association of British Electrical Engineers," which would be charged with the duty of looking after the material and individual interests of all administrative electrical engineers. This idea had met with the hearty approval and support of the President and Council of the Institution of Electrical Engineers, and it was hoped that the two bodies might be able to work in close co-operation. It had been decided that this new Association should be registered as a Trade Union, to bring it into line with the recommendations of the Whitley Reports. The general scheme was that the Association should consist of a number of sections, *e.g.*:—

Section 1.—Electricity Supply Engineers.
Section 2.—Electrical Plant Manufacturers' Engineers.
Section 3.—Electrical Contractors' Engineers, &c.

Each Section would have its own Council, and each Council would have representation upon the Grand Council of the Association. Such an Association backed by the I.E.E. should arrive quickly at a position of great strength and influence, and should be able to bring considerable pressure to bear whenever necessary in order to secure that qualified men were preferred and employed at satisfactory salaries. Their aim should be to make the profession of electrical engineering as much respected as the legal or medical profession, and equally closely guarded.

It had been proposed that the Electricity Supply Engineers' Section of the Association should be composed of Members and Associate Members having the following qualifications:—

Members.—Members shall be engaged in the business of electricity supply, and shall be corporate members of the Institution of Electrical Engineers.

Associate Members.—Associate members shall be persons of good general education engaged in the business of electricity supply, and they shall have had at least one year's training at an approved technical college, or two years' apprenticeship in an approved firm, company, or corporation, or shall have been engaged in an electricity supply undertaking in a responsible technical position for at least two years.

No more detail had been decided upon at present. It was felt that the best procedure would be to get the matter talked over at each Local Section, and afterwards to call a mass meeting in London.

He believed Mr. Wordingham would be good enough to act as first president, which would ensure that the Association would be launched with a good skipper at the helm.

Mr. H. W. Clothier said that he attended the meeting of the Council in London on Thursday last week, and that meeting unanimously supported this movement. The question whether the Association should be registered as a Trade Union had been fully considered, and it was agreed that the Association should be registered under the Trade Union Act, not only for the purpose of putting it on a proper legal footing on lines similar to other Associations, such, for instance, as the Cable Manufacturers, but it was also essential that it should be so registered in order to give it the necessary authority and status in connection with the steps taken by the Government in the reconstruction of industries.

Mr. Wordingham was conferring with the officials of the E.P.E.A. with a view to incorporating that enterprise with the work of the Committee which Mr. Robinson represented. There was vital necessity for unity.

General discussion followed, and after Mr. Robinson had replied to questions, it was unanimously resolved:—

"That this meeting of electricity supply engineers of Newcastle and district, promoted by the Newcastle Local Section of the Institution of Electrical Engineers, supports the formation of an Association of British Electrical Engineers, and appoints delegates to represent it at a mass meeting to be held in London under the chairmanship of the President of the Institution of Electrical Engineers."

The following delegates were appointed:—Messrs. W. T. Dalton, J. Cusworth, C. Vernier, M. F. Sheedy, H. S. Ellis, P. S. Thompson.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Hull Tramways electrical engineer, Mr. J. Wilkinson, who recently received a letter from the Controller of Coal Mines appointing him district engineer in connection with the coal economy campaign, cannot accept the post owing to his state of health. With the approval of the Committee, he nominated Mr. R. G. Elliott to take up the work.

At the Northampton T.C. the tramways manager reported that Mr. W. E. Owen, superintendent at the power station, had resigned, but before filling the position he was making application to the military authorities for the release of Mr. E. Jordan—former power station superintendent—who had been passed by the military as fit for home service only. The Committee approved of the action of the manager.

Leeds E.C. has made the following re-arrangement of staff:—Mr. T. Went to be manager of the meter and stoves department and superintendent of meter inspectors, at £350 per annum; Mr. E. H. Leask to be superintendent of sales and furnaces departments, at £320 per annum; Mr. E. H. Halliwell to be assistant superintendent of meter inspectors, at £170 per annum.

The Bournemouth E.C. has re-affirmed its former recommendation as follows:—"That a bonus of 1 per cent. on the net profits for the year be granted to the general manager and the assistant manager—four-fifths thereof to the general manager and one-fifth to the assistant manager. This bonus to be regarded as in respect of the work of the year covered by the report."

The Tunbridge Wells Council has unanimously decided to increase the salary of the borough electrical engineer, Mr. R. N. Torpy, by £100 per annum.

The Leicester T.C. on Tuesday raised the salary of Mr. T. R. Smith, the chief electrical engineer, from £900 to £1,000 per annum. The War Bonus Committee, in their report, stated that the officials of the electric supply department were in most cases entitled, under the provisions of Sir George Askwith's award, to their salaries, war bonus, and 12½ per cent. The circumstances were peculiar, and the Committee recognised that the Tramways Committee, in making the recommendations contained in the previous report, were actuated by a desire to adjust matters as far as practicable. The Committee made the following recommendations upon the understanding that the salaries in question would be readjusted upon the declaration of peace, and also subject to all the officials concerned making no claim of any war bonus or other war payment now obtaining, or which may obtain during the war:—W. Barton, resident engineer, Aylestone station, £325 to £425; T. Tyson, resident engineer, Lero station, £300 to £396; H. E. Rogers, mains superintendent, £225 to £312; E. J. Riley, chief clerk, £228 to £320; J. Barker, electrical assistant, £223 to £309; G. Morris, car sheds superintendent, £285 to £380; H. Pool, accountant, £301 to £350.

General.—Mr. Harrison Barrow, Chairman of the Birmingham Tramways Committee (and a prominent member of the Society of Friends), has been sentenced to six months' imprisonment for an offence under the Government Regulations by being a party, as acting-chairman of the Friends' Service Committee, to the printing and publication of a leaflet, "A Challenge to Militarism," without mentioning on it the name of the author, or submitting copies to the Press Bureau. Notice of appeal was given, and Mr. Harrison Barrow was allowed bail. He has since resigned his public work in Birmingham pending the re-trial.

At the Hull Education Committee, the Director of the Technical College reported that in response to the advertisement for a lecturer in electrical engineering to be attached to the mechanical engineering side, three applications had been received, and Mr. P. L. Bernstein, of the College of Technology, Manchester, who had been invited to attend that meeting, was the only suitable candidate. It was stated that Mr. Bernstein's parents were of Dutch nationality, and came from South Africa, and that he was a Grade 3 man. After Mr. Bernstein had been interviewed, it was decided to appoint him at £175 per annum, rising to a maximum of £250 per annum, plus the usual payments for evening classes.

Birthday Honours.—We are sure that the numerous friends and admirers of Mr. T. O. Callender, managing director of Callender's Cable & Construction Co., Ltd., will desire to join with us in heartily congratulating him upon the honour conferred upon him in the King's Birthday Honours. Mr. Callender, who has been a J.P. for Kent since 1915, becomes a Knight, in recognition of his "active leadership in local patriotic work," says the *Times*, but readers of these pages will regard the honour as most fittingly bestowed upon him as one of the leaders of an important section of British electrical industry. Such honours fall so sparingly to our representative electro-industrialists that when they do come for sterling merit, as in this case, the whole profession and industry basks temporarily in the sunshine of Royal favour. Some of the outstanding qualities of Sir Thomas Octavius, and the strength of character that has contributed so much to the building up of his own reputation and the success of Callender's Cable Co. were referred to in these pages on the occasion of the celebration of his silver wedding.

Mr. Guy Calthrop, who has so successfully filled the office of Controller of Coal Mines during the past year and more, receives the honour of Baronetcy.

Sir Charles Petrie, a former Lord Mayor of Liverpool, and a man of great distinction in the public life of that city, also becomes a Baronet.

Sir E. A. Goulding, Bart., M.P., who is made a Privy Councillor, is a director of the British Westinghouse Electric and Manufacturing Co., Ltd., and of the Westminster Electric Supply Corporation, Ltd.

Roll of Honour.—Sergeant Norman Fairall, son of Mr. G. W. Fairall, electrical engineer, of Wolverhampton, has been awarded the Military Medal. Sergeant Fairall, prior to the war, was on the electrical staff of the India-Rubber Co., Silvertown, and he joined the Forces at Sydney, Australia. He was wounded in October, 1917.

Norman Gripper, attached as a driver to the Friends' Ambulance Unit of the British Red Cross under the French Army, has been killed in action, aged 21. Prior to enlistment he was on the staff of the Blackburn Corporation electricity works.

Corporal S. Myatt, Northumberland Fusiliers, who has fallen in action, was an employé of Messrs. Siemens Bros., of Stafford.

Private S. Page, who enlisted from the works of Messrs. Callender's Cable Co., has died of wounds.

Company-Sergeant-Major G. H. Williams, King's Liverpool Regiment, who has fallen in action, was on the staff of the Herne Bay Gas & Electricity Co.

The Blackpool Tramways Committee has decided to make a grant of £500 for endowing a cot at the Victoria Hospital in memory of the late Lieutenant Stanley Boughey, V.C., of Blackpool, who lost his life under heroic circumstances during the fighting which led to the capture of Jerusalem.

Sapper A. H. Morey, of the Royal Engineers, an employé of Messrs. Alex. Hawkins & Sons, of Southwark, has been awarded the Military Medal for gallantry in action.

Rifleman J. McGovern, Queen's Westminster Rifles, who was in the electricity department of the Ilford U.D.C., has been wounded.

The Military Medal for gallantry has been awarded to Lance-Corporal S. Burton, R.E., who was at the Bexhill-on-Sea Corporation electricity works.

Private H. Hardy, Northumberland Fusiliers, formerly an electrician with Messrs. Pilkington Bros., Ltd., of St. Helens, who was recently reported killed, is a prisoner of war.

Bombardier H. Archer, R.F.A., killed by a shell explosion, was an electrician at the power house of Messrs. Dorman and Co., of Stafford.

First Air-Mechanic F. Suthurst, R.A.F., killed in action, aged 25, was formerly engaged in the electrical department of Messrs. Kelsall & Kemp, Ltd., woollen manufacturers, Rochdale.

Gunner G. F. Evers, who has died of wounds, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Second-Lieutenant N. J. V. Crowther, R.G.A., who has been seriously wounded in France, was an electrical engineer at Messrs. Vickers' works at Sheffield.

Private C. J. Humphreys has been missing since April 24th. Before the war he was employed at the electrical laboratory, South Parks Road, Oxford.

Lieutenant W. W. Tweedy, R.E., who was for some years with Messrs. James Gordon & Co., of London, W.C., as chief engineer in their sales department, died last week in France of wounds received in the recent fighting. Lieutenant Tweedy was a native of Kendal.

The *Times* states that Lieutenant-Colonel D. H. Hyde-Thomson, who was killed while flying in Kent on May 21st, passed from Clifton College into the Royal Navy. After a brief period of sea time, he joined H.M.S. *Vernon*, and qualified as a lieutenant (T). "He joined the Royal Naval Air Service during 1914, and was associated with the early experimental work. During the war he spent brief periods at Dunkirk and in the Mediterranean, and the rest of the time was employed at the Admiralty and Air Ministry on important work. Latterly his energy was devoted chiefly to wireless telegraphy and electrical matters, in which branch the loss of his services will be greatly felt."

Chief Engineer Lyons, R.N., who was on the staff of the Hull Corporation tramways department, has been awarded the D.S.M. for conspicuous gallantry and devotion to duty during naval operations in the Irish Sea. He is now convalescent after being in hospital with wounds.

Corporal J. N. Atkinson, 31/M.G.C., previously reported wounded and missing, has written home saying that he is wounded and a prisoner of war at Altdamm, Pomern, being very kindly treated. Corporal Atkinson was taking the four years' course at the B.T.H. Co., Rugby, prior to enlisting in the H.A.C.

Lance-Corporal F. Woods, London Regiment, late of the India-Rubber Co., Silvertown, died of wounds in France on or about May 14th. Private L. North, London Regiment, formerly in the general office of the same company, is a prisoner of war in Germany.

Obituary.—Herr. H. Bissnger.—The death is announced from Munich, at the age of 61 years, of Herr. H. Bissnger, for many years Technical Director of the Electricitats Gesellschaft vormals Schuckert & Co., of Nuremburg.

Mrs. A. H. E. Padley.—We regret to hear from Mr. F. S. Grogan that Mrs. A. H. E. Padley, late chief lady demonstrator, St. Marylebone electric supply kitchens, died at Loughborough on Thursday last week. Mrs. Padley, who was well known in electric cooking circles, wrote many valuable articles on electric cooking, and made a number of useful suggestions upon the design of cooking apparatus.

NEW COMPANIES REGISTERED.

Monometer Manufacturing Co. (1918), Ltd. (150,557). Private company. Registered May 28th. Capital, £16,000 in £1 shares (15,000 8 per cent. cum. pref.). To take over the business of engineers, &c., lately carried on by the Monometer Manufacturing Co., Ltd., at Birmingham, and to carry on the business of mechanical, hydraulic, electrical, and general engineers, watch and clock makers, manufacturers of and dealers in printing, typesetting, and type casting machinery, manufacturers of monometers, pyrometers, thermometers, heat regulators, and other apparatus, &c. Agreement with H. J. Thomas. The subscribers (each with one pref. share) are:—H. J. Thomas, 130, Bute Street, Cardiff, stockbroker; W. H. Gould, Vulcan Foundry, Bute Docks, Cardiff, engineer. The first directors are: H. J. Thomas and W. H. Gould. Qualification, £500. Solicitor: H. T. Cox, 31, High Street, Cardiff.

Waste Utilisation, Ltd. (150,573)—Private company. Registered May 29th. Capital, £1,000 in £1 shares. To utilise waste products of all kinds, and to carry on the business of agricultural, mechanical, electrical, gas, and general engineers, &c. The subscribers (each with one share) are: H. C. Hobbins, 4, Broad Street Place, E.C., chartered accountant; W. A. Ward-Jones, 7, Queen Street, E.C. 4, solicitor. The first directors are not named. Solicitors: Mawby, Mawby & Morris, 7, Queen Street, E.C. 4.

Metallurgists, Ltd. (150,599).—Private company. Registered May 31st. Capital, £12,000 in 6,000 7½ per cent. tax free participating preference shares of £1 each, 5,000 ordinary shares of £1 each, and 10,000 deferred shares of 2s. each. To carry on any business in connection with processes for depositing metals on internal-combustion engines and manufacturing such engines and their component parts, &c., and to adopt an agreement between Sherard Cowper-Coles and J. Porter. The subscribers (each with one ord. share) are:—Sherard Cowper-Coles, Sunbury-on-Thames, metallurgist, J. M. Cobbam, 33, Southampton Street, W.C. 2, solicitor. The first directors are: Sherard Cowper-Coles (technical director) and Gustave E. de Brunner (administrative director). Qualification, £100. Registered office: 35, Long Acre, W.C. 2.

CITY NOTES.

Industrial and General Trust, Ltd.

In the course of his speech at the annual meeting, Sir George Touche, M.P., in referring to the question of national reconstruction, said he hoped that in the future the commercial expert would no longer be ignored in the equipment of our foreign Embassies and Legations. He added that although the old attitude of indifference to the development of the nation's industries was breaking down, it still lingered in some quarters. This was illustrated by the recent fate of the Water Power Bill promoted by the British Aluminium Co., whose development they had assisted financially in times past. Owing to the opposition of a few Scottish Peers and their friends the Bill had been temporarily withdrawn, although it was regarded favourably by the Board of Trade and the Ministry of Munitions. The fuller development of what the war had proved to be an essential industry had thus been delayed. The scheme would have submerged only a few hundred acres of inferior deer-grazing land and marshy ground. On the other hand, it would have supported a new village of from 6,000 to 8,000 people, helped to develop a key industry, given permanent employment under healthy conditions, and, if authorised now, would have been ready to absorb labour during the difficult period of demobilisation. Yet it was being hung up indefinitely on grounds largely sentimental and wholly reactionary.

Shanghai Electric Construction Co., Ltd.

At the annual meeting, held last week, Sir Alfred Dent said that the available balance was £70,014, against £49,509 last year. They had not yet agreed the amount of excess profits duty for 1917, but anticipated a portion of the carry-forward reserved for this purpose would be available for the 1918 account. They had again converted the profits at the rate of 2s. to the dollar, so that the first portion of the profit and loss account, which recorded transactions in Shanghai, formed a true basis for comparing one year with another, and reflected the actual progress of the undertaking. By far the greater part of the profits had been remitted home, and the profit on exchange, amounting to £17,852 as against £1,810 in the preceding year, was shown as a separate item, and represented the benefit which the company had derived from the rise in the value of silver. This method of accounting was important, since it distinguished clearly between the two main causes of the prosperity which the company enjoyed last year.

In regard to road maintenance, the arrangement with the Municipal Council had been confirmed by the ratepayers, under which the company's entire obligation was commuted by an annual payment of Tls. 16,500, which included a fixed amount to cover future increase in wear and tear. The amount was subject to revision every ten years so far as the actual cost of wages and materials might call for variation in either direction. It was well that their liability for road maintenance, which in course of time would have included the cost of replacement, was now ascertained and defined by a mutually satisfactory agreement which would also effectively prevent the question again becoming the subject of troublesome discussion between the Council and the company. The unclaimed dividends, amounting to £22,140, represented moneys held back on account of Continental friends to whom they could not remit under present circumstances. The company was under no legal obligation to allow interest, but it had had the use of this money, and as it did not wish to make a profit out of the misfortunes of its shareholders resident abroad, they had under the circumstances credited them with interest, £1,062.

The financial position of the company had materially improved, and there was every reason to believe this progress would be maintained; the result of working for the first four months of 1918 (a comparatively slack time in their receipts) being estimated to show a profit of about £175,000.

As regarded the railless service, to which they attached much importance, they were still in negotiation with the Council, and hoped soon to get sanction to carry out at least part of the comprehensive scheme that they had laid before them. The advantages of this mode of traction were obvious as against the permanent rail, and it had certainly been much appreciated by the public and by owners of property along the short distances now in working. The Native staff, which consisted of six different nationalities, numbers 1,220; they had worked with increased efficiency and a complete freedom from labour troubles. Last year they carried nearly 73½ millions of passengers and covered a distance of over four million miles.

Great credit was due to Mr. McColl for his able work and administration under the trying circumstances of a depleted staff and increased cost of all materials.

Calcutta Electric Supply Corpn., Ltd.

At the annual meeting of this company the Chairman said that the capital expenditure during the year had been very small, owing to restrictions on the supply of materials, and this to a considerable extent had prevented any large expansion of the system. After referring to the causes of increase in revenue expenditure, the chairman said that the carry forward was less than for 1916, chiefly due to the provision for excess profits duty, but it was still larger than would be necessary in normal times. The need for providing for unexpected demands in war time made it expedient to keep a substantial sum in hand. They had been enforced to curtail their supply owing to the necessity for economising boiler power, and the impossibility of obtaining sufficient bitumen and other materials for carrying out extensions. They had now been advised that their coal contracts had been cancelled, and that they would have to make shift with whatever amount and quality of coal the contractors were permitted to deliver. A 10-year contract with the Government had been practically settled for the supply of current to an extension of their Ordnance Factory at Cossipore, which adjoined their generating station. Their requirements would probably reach about 1,600 KW. A scheme had been approved for gradually changing sections of their overhead mains to underground, with a view to diminishing the chance of breakdown from falling trees, &c., during storms, but owing to lack of material the carrying out of the work had had to be postponed. This principle of replacing overhead by underground mains was one which they considered of great importance, and they proposed to keep it constantly in view. It foreshadowed considerable expenditure in future years. They had been fortunate enough to get delivery of a repaired rotor belonging to one of their generating sets, which rotor, but for the war, would have been delivered during 1914. The costs incurred for freight and insurance had been extremely heavy, but it completed their available plant capacity to 21,800 KW. In regard to the question of their charges to the public for electric current, at the last meeting he announced their intention of reducing the then effective flat rate of 4 annas for combined light and power consumption to one which was 3¾ annas, and he told them that the cost to them of this seemingly small reduction in rate was estimated to be between £12,000 and £14,000 in a full year of operation. This estimate was very carefully made, but it was based on a census of their consumers taken in 1912. They had since obtained a new census of the 1917 consumers, and found the somewhat amazing fact that consumers of no less than nearly 2,000,000 domestic power units, and over 3½ million light units who might have benefited during the last half of 1917 by the reduced rate had failed to do so. The money which the consumers might have saved themselves in a full year was about £12,000, excluding meter rents. Consumers of about ¾ million units who had taken advantage of the new rate had profited by some £1,600 during the half-year. The estimate of their anticipated loss of revenue was quite accurate, and it was not their fault that the benefits offered had not been fully taken advantage of by the public. There was still some grumbling among a limited section of the Calcutta public at their rates, and a curious anomaly arose of people cavilling at rates and yet failing, to the great extent indicated above, to take advantages offered. During the four years ended December 31st, 1917, the public had benefited by reductions of charges for lightng to the extent of at least £57,000. In the face of the figures, it was surprising that anyone could be found to suggest that the company had not dealt fairly in sharing its prosperity with its consumers. The company's action in reducing rates had, so far, been justified by results, but further development in this direction was greatly hampered by the "fog of war," which must continue to affect them in a marked degree, and obscured the data upon which to base calculations. They had to face increased cost of plant, freight, and insurance. They were faced, too, with reduced output owing to steps necessarily taken by the Government to restrict coal consumption. The increased cost of living and the general rise in wages had caused additional expenditure, and pointed to further outlay to come. They would, therefore, readily understand that relinquishment of revenue at the present time, when almost every supply undertaking similar to theirs was increasing its charges, was a measure very closely to be examined. The reduction of revenue to which they were liable on account of the 3¾ annas flat rate, if fully taken advantage of, was £12,000 to £14,000, and the additional reduction of revenue due to a 3½ annas rate was estimated to be £6,500, approximately half of which would fall on the year 1918 if such a rate commenced on July 1st. After very full and anxious consideration they had decided, in continuation of their policy of associating shareholders and consumers in the success of their undertaking, to increase the dividend on the ordinary shares by ½ per cent.—from 9½ to 10 per cent.—for the year 1917, and at the same time they had authorised their agent to announce a reduction in the scale of combined flat-rate for lighting and domenstic power to 5 annas, with an immediate rebate of 1½ annas, under the usual conditions, that was a 3½ annas flat rate to all who chose to avail themselves of it. This rate would apply to consumers of 60,000 units or less per annum; for larger consumers further rebates would continue to be given as at present. They had revised all salaries from January this year at a cost of £2,600 in 1918, and a pension fund was to be inaugurated with £7,500. It was an opportune moment to start this fund when they chanced to be making a very considerable profit by Exchange.

Marconi Wireless Telegraph Co. of America.—A financial daily states that a dividend of 25 cents per share of $5 is announced.

France.—La Compagnie Générale de Télégraphie sans Fil is the name of a new company which has lately been formed in Paris, with a capital of £500,000.

Peel-Conner Telephone Works, Ltd.—For the year ended March 31st, 1918, the net profit was £22,902, out of which £10,000 has been put to reserve, leaving £12,902, plus £5,188 brought forward. The preference dividend for the year absorbs £5,000, and a dividend of 2s. per share on the ordinary shares, free of tax, requires £8,000, leaving £5,090 to be carried forward. The result of the year's trading has been satisfactory, which is largely due to Government contracts reverting, to a considerable extent, to the company's standard work.

Brotherton Tubes and Conduits, Ltd.—The report for the year ended March 31st shows a trading profit of £15,266. After adding transfer fees and deducting depreciation, interest, directors' fees, &c., and adding £6,771 brought forward, a balance of £19,793 remains. The directors recommend a dividend of 1s. per share, less tax, and to carry forward (subject to excess profits duty) £17,355.—*Financial Times.*

Doulton & Co., Ltd.—After paying the preference dividend for 1916, £51,203 remains, which the directors propose to carry forward.

United River Plate Telephone Co., Ltd.—Final dividend, 5 per cent. on the ordinary capital, making 8 per cent. for the year, free of income-tax, carrying forward £17,307.

Western Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1918, being at the rate of 6 per cent. per annum.

Canadian General Electric Co., Ltd.—Quarterly dividend 2 per cent. to June 30th.

La Plata Electric Tramways, Ltd.—After paying debenture interest, £10,359 remains, and it is to be carried forward.

STOCKS AND SHARES.

Tuesday Evening.

The principal feature of the past week in the markets devoted to electricity issues has been the publication of the report of the Select Committee appointed by the Government for considering the whole question of electric supply throughout the country. The Committee's recommendations are certainly sweeping. They cover an extremely wide ground, ground so wide, in fact, that the recommendations are regarded in the Stock Exchange as being outside the pale of practical politics, at any rate until the war is over. The markets in the shares have hardly varied to the amount of an eighth, and those who should be in a position to understand what is likely to be the effect of bringing into operation such a scheme with regard to electricity supply companies are fain to admit that they cannot see their way to express any useful opinion as things are now. Had a scheme on a smaller scale been suggested, and one capable of being put into working order in spite of the increasing difficulties that surround the whole question of man-power, there would probably have been some reflection of the proposals to be seen in market quotations, but, as already noted, the idea is considered to be too vague, large, and nebulous to bring it into view as a practical prospect.

The principal rise in the electricity markets is a jump of 17½ points in Brush Electric Ordinary stocks, raising the price from 42½ to the neighbourhood of 60. This came about as the result of a declaration by the company of dividends for 1916 and 1917 on the ordinary stock of 6 per cent. per annum. That something favourable was in the wind there had been previous hints, and, as we mentioned last week, the quotation of 40 to 45 was misleading, inasmuch as a seller could have placed his holding at the higher figure, but it is doubtful whether, even at the present advanced price, a buyer would be able to pick up much stock if he wanted to do so.

Investment of the War Loan money is the outstanding feature in the gilt-edged departments around the House, and this has continued to exercise a strengthening effect upon good-class debenture and preference issues amongst industrials. Business on the whole remains very quiet, and a good deal more interest for the City man centres around Conduit Street than Throgmorton Street. Dealers in some of the telegraph and cable shares complain humorously of the lack of consideration shown by shareholders in the companies, who decline to realise their shares, and thus to create business in the market, which at present is impossible in consequence of the fact that there are many more buyers than sellers. Even to accommodate the Stock Exchange, however, it may be doubted whether proprietors should part with such excellent investments at the present time.

Further rises have taken place in the market for cable stocks. Eastern Extensions, Westerns, Eastern Ordinary, Indo-European, Cuba Submarines are all higher. Some buyers go further afield, and are trying to pick up West India and Panama first and second preference shares, which certainly look cheap at 8½ and 67½ respectively, in view of the prosperity attendant upon the cable industry as a whole. The American group is quiet, with no particular feature. The United River Plate Telephone Co. has declared a dividend of 5 per cent., making 8 per cent. free of tax for the year, which is the same as that of the previous 12 months, and the price has risen 3s. 9d. Chile Telephones are 10s. higher. Marconi issues are quiet, even to stagnation, and, as usual in such conditions, the tendency is to let prices sag away. Henley's and Callender's are both a good market, and the same description applies to various others in this particular section.

General Electric Ordinary are 10s. up at 20¾. British Aluminiums have recovered a small fraction. Edisons are quiet at 2⅝. Yorkshire (West Riding) Electric Ordinary spurted 5s. to 22s. 6d. London & Suburban Traction Preference are better at 6s. 9d., and the "A" debenture at 79½.

Anglo-Argentine Tramways are a good spot, the first preference rising 3/16 to £3, and there being buyers about at the price. Mexican Light & Power Common gained 2½, although the first mortgage bonds are a point lower at 37½. British Columbia Electric Deferred continued its rise, Rio Tramways Firsts advanced to 88½, and other issues in the foreign division are distinctly steady. The home railway market is undecided, with Districts ½ up at 15, on fare-raising possibilities, and Underground Income "A" gaining a few pence at 5s., while, on the other hand, Metropolitan Consolidated receded to 20½. Business in home railway stocks is still of the minute order, but the market is fairly well maintained in sympathy with the strength of gilt-edged issues.

The engineering group is a little dull. Babcock & Wilcox have receded to 3 5/16. Chemicals are quiet, with no change in Castner-Kellner. Amongst armament shares, Vickers have improved to two guineas. The rubber market is depressed, because of a further fall in the price of the raw stuff, while amongst metal shares, those in the tin division attract a little attention.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price June 4, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅞	—	£7 8 0
Charing Cross Ordinary ..	5	4	8¼	—	6 3 1
do. do. do 4½ Pref..	4½	4½	3¼	—	6 18 6
Chelsea	8	5	8	—	8 6 8
City of London	8	8	11¾	— ¼	6 13 2
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10⅜	—	6 13 4
do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
Kensington Ordinary	6	7	5⅞	— ⅛	6 18 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 13 10
Metropolitan	8	4	3¼	—	6 8 1
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 13 4
St. James' and Pall Mall ..	8	9	7	—	6 8 4
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1916.	Dividend 1917.	Price June 4, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	94	—	6 7 8
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	5	—	8¼	+ ½	4 17 0
Cuba Sub. Ord.	7	7	9¾	+ ¼	*7 8 7
Eastern Extension	8	8	16⅜	+ ¼	5 4 0
Eastern Tel. Ord.	8	8	157½	+ 2	*5 1 6
Globe Tel. and T. Ord.	7	—	14¾	+ ⅛	*4 15 0
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	24	22	38	—	5 15 9
Indo-European	18	—	49	+ ½	6 12 8
Marconi	15	—	3⅛	—	4 17 10
Oriental Telephone Ord. ..	10	—	4 3/16	—	2 7 9
United R. Plate Tel.	8	8	7 3/16	+ 3/16	*5 11 4
West India and Pan.	6d.	9d.	1⅛	—	*3 6 8
Western Telegraph	8	8	15¾	+ ⅛	*5 1 5

Home Rails.

	Dividend 1916.	Dividend 1917.	Price June 4, 1918.	Rise or fall this week.	Yield p.c.
Central London, Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	20½	— ¼	4 17 5
do. District	Nil	Nil	15	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1¼	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	76½	— ½	5 4 7

Foreign Trams, &c.

	Dividend 1916.	Dividend 1917.	Price June 4, 1918.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams, First Pref.	5½	5½	3	+ 3/16	—
do. 2nd Pref. ..	5½	—	2½		—
do. 5 Deb. ..	5	5	65xd	—	7 18 10
Brazil Tractions	—	—	43	—	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	60½	—	8 5 4
do. do. Preferred	Nil	Nil	42½	—	Nil
do. do. Deferred	Nil	Nil	85	+ 1	Nil
do. do. Deb.	4½	4½	63	— 1	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	37½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	80	—	Nil
Mexican Light Common ..	Nil	Nil	21	+ 2½	Nil
do. Pref.	Nil	Nil	26½	—	Nil
do. 1st Bonds ..	Nil	Nil	37½	— 1	—

Manufacturing Companies

	Dividend 1916.	Dividend 1917.	Price June 4, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3 5/16xd	— 1/16	4 10 8
British Aluminium Ord. ..	10	10	1 3/32	+ 1/32	6 0 10
British Insulated Ord.	20	20	3¼	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 1/16	—	6 9 4
Callenders	20	—	17½	+ ¼	5 16 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	20	20	3 5/16xd	—	6 0 10
Edison Swan, fully paid ..	—	—	2⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1 5/16	—	7 12 4
Gen. Elec. Pref.	6	6	10¼	—	5 15 8
do. Ord.	10	10	20¾	+ ½	4 16 5
Henley	25	25	20¼	+ ½	6 0 6
do. 4½ Pref	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	1⅜	—	*6 8 0
Telegraph Con.	20	20	42½	—	*5 18 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£75	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£43	..
a Copper Sulphate	,,	£57 10/-	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	
a Shellac	per cwt.	£16 15/-	15/- dec.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	1/1	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c ,, Tubes (solid drawn) ..	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn) ..	,,	1/7 to 1/7½	..
g ,, Bars (best selected) ..	per ton	£147	..
g ,, Sheet	,,	£147	..
g ,, Rod	,,	£147	..
d ,, (Electrolytic) Bars ..	,,	£125	..
d ,, ,, Sheets ..	,,	£152	..
d ,, ,, Wire Rods	,,	£133	..
d ,, ,, H.C. Wire	per lb.	1/4	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	3d. inc.
h Gutta-percha, fine	,,	6/10	
h India-rubber, Para fine	,,	3/1	2d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large ..	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	4/6	..

Quotations supplied by—

a G. Boor & Co.	*g* James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	*h* Edward Till & Co.
d Frederick Smith & Co.	*i* Bolling & Lowe.
e F. Wiggins & Sons.	*l* Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*n* P. Ormiston & Sons.
	r W. F. Dennis & Co.

City and Guilds Institute.—Sir Edward Busk, presiding at the annual meeting of the City and Guilds of London Institute, said that a considerable amount of research work had been carried out, partly to continue previous investigations and partly in new directions. In the department of technology 8,905 candidates were examined, as against 10,184 in the preceding year.—*The Times*.

Additions to the Commonwealth Edison Plant.—No better evidence of the difficulty of keeping pace with the demand of a great and rapidly growing city can be found than in the description of some of the new work at the Northwest station of the Commonwealth Edison Co. in the *Electrical World* of May 4th. The first plant contained two 20,000-KW. units, to which have now been added three 30,000-KW. turbo-generators and one of 35,000 KW., the last-named for 25-cycle operation like the original plant. When in full operation the station will be able to furnish 85,000 KW. at 25 cycles and 80,000 KW. at 60 cycles. To provide for this immense output corresponding changes have been necessary in the boiler room. Each of the first two machines of 20,000 KW. was fitted with 10 boilers per set. The last generators, in spite of their greatly increased rating, have only five double boilers each. This change is an impressive demonstration of the tendency towards getting boiler units somewhere nearly commensurate with the generator capacity.

The additions to the plant have also involved a general change from steam to electric drive for all the auxiliaries, a change thoroughly in keeping with the general trend of practice for obtaining higher efficiency and greater convenience. All the new units are equipped with direct-connected exciters, and the circuits are so connected that each unit can be fully controlled from its own particular panel. They are all, too, equipped with control relays which are somewhat unusual in the thoroughness of the operations conducted by them. When tripped they act in succession to open the main generator switches, the generator field switch, the generator neutral switch, and the ventilating-fan switch in the case of the machines which have artificial ventilation. Exploring coils installed in the generators are connected to temperature indicators in the operating gallery, and similar coils in the air intakes of the machines give continuous indications of the temperatures reached in operation. Interesting details regarding the arrangement of the switchboard connections and apparatus in the plant are included.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The annual general meeting of the Institution was held on Thursday last week. The President, Mr. C. H. Wordingham, introduced the report of the Council with a running commentary, in the course of which he emphasised the importance of developing the social and commercial sides of the Institution, as well as the scientific side. The code of regulations for the electrical equipment of ships, he said, had made good progress, and would be published in the late summer or early autumn in a form handy for the pocket. Regarding the Board of Trade report on electricity supply, issued that day, he said that the position taken up by the Council, which had given evidence before the Committee per Mr. C. P. Sparks, at that time President, had been thoroughly justified by the event. A reference to the metric system in the report required some explanation: The Engineering Standards Committee had given permission to the sectional committees to employ the metric system for the dimensions of their standards if the respective industries so desired; but although the electrical manufacturers wished to adopt this course, difficulties were met with owing to the unavoidable occurrence of inch and metric measures on the same drawing. The E.S.C. therefore asked the electrical industry to state definitely what it wanted—should the fundamental dimensions be standardised in even figures on the metric or the inch scale? The Council called a conference at which the Institution, the B.E.A.M.A., the C.M.A., T.L.A., and the B.M.A. were represented, the discussion being confined to one narrow issue—whether the E.S.C. specifications should continue to have the fundamental dimensions in even British units, or whether they should now be made metric. The conference decided that the present was not an appropriate time to make the change, but that the metric equivalents might be given in addition to the inch measurements. The President briefly outlined the system which was being gradually built up by the Engineering Training Organisation, and described the prompt action that was taken by the Council in connection with the order for reducing the consumption of electricity, which action had exercised a material influence on the decisions of the Fuel Controller. He concluded by remarking that the Benevolent Fund did not receive sufficient applications for relief, and therefore could not make an effective appeal to the members for support.

Seconding the motion to adopt the report, Mr. C. P. Sparks said that its contents bore witness to the immense amount of work that had been done by the President himself.

Mr. H. Boot drew attention to the peremptory order issued by the Controller of Munitions Mineral Oil Production to users of Diesel engines, requiring them to adapt their engines for the consumption of tar oils by March 31st—three weeks' notice—and said that the device recommended by the Controller had been tried on a plant with which he was concerned, but had proved a failure, and involved the company in considerable expense.—The President stated that the I.E.E. Committee had had nothing at all to do with the recommendation in question.

Mr. Boot further protested against the indiscriminate order for a reduction in the use of electricity, advocating a system of rationing by the number of rooms or occupants, and the President said the same views had been strongly urged by the Committee of the I.E.E. Lastly, Mr. Boot said the members owed a debt of gratitude to Mr. Wordingham for developing the social and business sides of the Institution.

Mr. H. Allcock regretted the manner in which the Council had dealt with the metric system in the report; the Institution had officially advocated the general adoption of the system in this country, and he thought that some such explanatory statement as the President had made should be inserted. It was, of course, unreasonable to expect the I.E.E. or any other body to isolate itself by adopting the metric system before it came into general use.—In reply, the President pointed out that the conference included other bodies besides the Institution.

Mr. E. C. Barton considered that it was a very serious matter; the meeting of the I.E.E. which discussed the subject was almost unanimously in favour of the general adoption of the metric system—not, of course, its sectional adoption—and he thought an explanation should be added to the statement in the report.—The President replied that manufacturers and traders were conspicuously absent from the meeting; it was essentially a commercial matter, and the Institution *must* consult the bodies immediately interested in it. The persistence of old units in metric countries had nothing to do with the real point at issue, which was the adoption of the metric system in engineering. The meeting referred to was intensely disappointing, and afforded no definite guidance to the Council.

Mr. E. T. Williams pointed out that a great deal of criticism was directed at the Institution in the past, but this was no longer the case. He had been grieved in the past to see qualified men holding aloof from the Institution or dropping their membership; the time had now come when every qualified man should join the Institution, as a duty, and individual members should use the power at their command in filling appointments to make membership of the Institution a qualification of considerable importance.

Mr. G. Semenza said that the Italian Electrotechnical Association was also drawing up rules for the electrical equipment of ships, and suggested international agreement on the subject. With regard to the metric system, in Italy everybody desired that English trade should supplant that of Germany, but for this purpose the adoption of the metric system was essential. It was a matter of the highest importance.—The President, in reply, said he was extremely pleased to have Mr. Semenza present (the local hon. secretary of the Institution in Italy), and the Committee would welcome the collaboration of the Italian Association. A small committee would be set up to watch all these international relations and to secure joint action.

Mr. S. Evershed commented on the absence of criticism nowadays, in contrast with the experience of past years. The Institution was a living, growing organism, and the Council entirely changed its attitude because the members had changed theirs. While he did not object to the commercial side, he wished to see the scientific side of the Institution developed, because manufacturers needed boosting on that side lest they should be outdone after the war.—The President agreed, and announced that the Council was taking active steps to develop the scientific side of the Institution.

Mr. P. M. Baker said that the reference to the metric system in the report might be quoted as a precedent, and urged that an explanatory note should be added. Plain members might have ideas serviceable to the various committees, and some channel of communication should be provided.—The President pointed out that members could write to the Secretary, and on Mr. Allcock's suggestion agreed that when new committees were formed an invitation to members to send in ideas should be inserted in the *Journal*.

The report was then adopted unanimously, and Mr. J. E. Kingsbury, moving the adoption of the accounts, said that the increase of membership and of subscriptions was very gratifying at such a time as the present. Expenditure had increased but little in spite of the high costs, and this year there was a balance to the good on the building. They could not expect to get as much for their money in the future as in the past, and therefore the Council had put £3,000 to reserve, a new feature in the accounts.

Few comments were made, and the accounts were adopted unanimously. Votes of thanks were afterwards accorded to the Institution of Civil Engineers, and the honorary officers of the Institution.

THE FARADAY SOCIETY.

General Discussion on "The Co-ordination of Scientific Publication."

A discussion on this subject, opened by the President, Sir Robert Hadfield, Bart., F.R.S., was held on May 7th at the rooms of the Chemical Society, Burlington House, W. Among those who took part were Prof. A. Schuster (Secretary of the Royal Society), Mr. M. Longridge (President of the Institution of Mechanical Engineers), Mr. C. H. Wordingham (President of the Institution of Electrical Engineers), Mr. Robert Mond, Mr. W. R. Cooper (editor of *The Electrician*), Mr. L. Pendred (editor of *The Engineer*), Mr. Edgar Worthington (Secretary of the Institution of Mechanical Engineers), Mr. G. Shaw Scott (Secretary of the Institute of Metals), Dr. C. E. Keane, Mr. F. S. Spiers (Secretary of the Faraday Society), and Messrs. Pearce, P. Peakman, and Wright. Written communications were received from Prof. R. C. Gregory (editor of *Nature*), Dr. C. H. Tripp, Dr. P. E. Spielmann, and Dr. J. O. Tunstall.

The discussion ranged from suggestions for preventing overlapping in the reading and publication of papers and the preparation of abstracts to consideration of a great central housing and library scheme for all the principal scientific and engineering societies, after the manner of the United Engineering Societies' building in New York, a striking photograph of which was shown by the President. It may be long before the big scheme comes into being, but, in the meantime, numerous practical and helpful suggestions were made which, if carried out, will enable the distracted man of science to find out what is going on in his own little corner of work, as well as in the greater sphere of knowledge, with a minimum of time and effort. Fortunately, the Conjoint Board of Scientific Societies was well represented at the meeting, and some of the ideas put forward will doubtless find a fruitful soil for development in that very excellent and necessary body. Indeed, one or two speakers favoured the notion of all papers being submitted to that or some other central body, and thence allocated to the separate societies, but little favour was given to this bold idea, the adoption of which, it was thought, would tend to stifle the individuality of the societies. All speakers, however, heartily supported the suggestion that the Board should publish a weekly bulletin of all papers to be read or published by the affiliated bodies, and that facilities for free intercourse should exist between the societies, so that meetings should be thrown upon wide to all and sundry. The policy of joint meetings for the discussion of "borderland" subjects was also widely advocated. One speaker made the practical suggestion that secretaries should consult one another systematically, when drawing up their programmes, as a means towards co-ordination and co-operation. The logical conclusion of this idea, the creation of a "secretary of secretaries," with, perhaps, a special President and Council, was also put forward in course of debate.

A very feasible method of facilitating co-ordination was to publish all journals of societies in a uniform size and type, and to issue reprints of all papers at a nominal charge to members of any Society. This is a reform that the Conjoint Board might well attempt to carry out. The systematic production of text-books or monographs, under the guidance of the Board, or of the Department of Scientific and Industrial Research, and the multiplication of really high-class special technical journals were other means which found favour for co-ordinating the vast stores of scientific knowledge and data constantly being accumulated, and for presenting them in a form readily available for swift assimilation.

Several speakers dwelt on the present unsatisfactory position as regards the production and publication of abstracts. The overlapping in this work is positively absurd. For example, abstracts of one branch or other of chemistry and chemical technology are at present being published by no less than some half-dozen societies. There is no reason why the whole matter of abstracting should not be in the hands of one central body—either the Conjoint Board or an *ad hoc* creation. The abstracts should be issued in sections, for any of which members of the affiliated societies should be entitled to subscribe at a nominal figure. One contributor thought that abstracting should even be internationalised, every country being responsible for the abstracts in its own tongue, as well as for translating those supplied by other countries.

Other suggestions worthy of consideration centred round the idea of amalgamating, or, at any rate, uniting much more closely than obtains at present, the present great and ever-growing number of special societies. It was admitted by nearly everybody that the need for specialised societies is a real one, and their value very pronounced, but there was every reason why groups of societies dealing with cognate subjects should co-operate closely, sharing the same building, pooling libraries, and granting special inter-society privileges to the members of all the units in the group. Sir Robert Hadfield and others went even further in advocating one great central building and library for all the great technical societies, like the house in New York already referred to. Sir Robert also instanced, in support of his scheme, the recently-formed German federation of six prominent technical associations, comprising a membership of some 60,000 technical experts. Certainly from many points of view, particularly in the facilities it would give for cataloguing and indexing on a really comprehensive scale, such a scheme would have great merits, and yet it was felt by many that such centralisation could go too far, and could become crushing—German-like—in its efficiency. Groups of societies and big sectional libraries, repeated as far as possible in the important provincial centres, is a solution of the problem not only in many respects more attractive, but also far easier of realisation, and if the discussion will have the effect of stimulating to greater activity a tendency already manifest, it will have served a truly useful purpose.

THE DEVELOPMENT OF THE BRITISH DYE-MAKING INDUSTRY.

One of the first results of the outbreak of hostilities between the United Kingdom and Germany was a forcible realisation of the fact that the great textile trades of this country were mainly dependent on German sources of supply for the colouring matters which are essential to those industries, and so important are the textile trades in British industry, and so vital to them is a supply of dyestuffs, that it was necessary for the Government to consider what steps should be taken to deal with the difficulties which had arisen. A committee representing the dye-consuming industries was appointed to consult with the Board of Trade, and, as a result of its deliberations, a scheme was prepared for the co-operation of the Government with the dye-users in an attempt to rid the industries of the menace which had been overshadowing them. This scheme provided for the formation of a limited liability company, with a proportion of Government advanced capital, with the object of re-establishing the synthetic dyestuff industry in this country. The Government agreed to make advances up to £1,500,000 on a mortgage debenture, and the company was authorised to raise £3,000,000 ordinary share capital, to be obtained from consumers of dyestuffs. The new company, with the style of "British Dyes, Ltd.," proceeded to allotment on April 1st, 1915, with an issue of one million £1 ordinary shares.

The company availed itself of the agreement made between the Board of Trade and a dye-making company in the North of England, and acquired the undertaking of that firm, and utilised the works of that undertaking as a nucleus for development. It was ultimately decided to acquire land in the immediate neighbourhood of the existing works, and various estates of a total area of nearly 500 acres were purchased. The general lay-out of the works embraces all the best principles of modern factory practice, and should enable the company to manufacture its products under the best conditions.

The manufacturers outside Germany were generally content to manufacture finished dyestuffs from imported German intermediate products. It was by holding a virtual monopoly in intermediate product manufacture that the Germans really controlled the dyestuff manufacturing operations of the whole world, and so long as they retain that monopoly no non-German firm will be free from aggression. The company, therefore, adopted the policy of developing as far as possible, the manufacture of intermediate products in Great Britain. An analysis of official statistics disclosed the existence of about 100 intermediate products of prime importance. Large plants for the manufacture of these substances have been designed and erected, and the company is at the moment manufacturing many intermediate products on a commercial scale. A very long series of processes are frequently necessary for the production of one intermediate product. It has been estimated that, of the capital to be expended by a dyestuff manufacturing company, for plant for dealing with coal tar products only, about 85 per cent. will be represented by intermediate product plant.

A dye-making factory requires not only the necessary chemical plant, but also large installations for providing services of high and low-pressure steam, electricity, power gas, compressed air, &c., and in the company's works are to be found large boiler houses, a central electric generating station, a Mond gas plant, &c. This type of construction has been very difficult to carry out under present conditions, but the provision of such services is essential.

A dye manufacturing company also requires for its operations large quantities of certain of the heavier chemicals, more particularly mineral acids. As supplies of such acids in this country were required for the manufacture of munitions of war, it was necessary that the company should erect its own plant for the production of these essential commodities. Consequently, the new works contain large plants for the manufacture of oleum and nitric acid.

In connection with the design of new plant, it has been found necessary to conduct a considerable amount of chemical research, and difficulties have been experienced by the company in securing an adequate supply of trained assistants to carry on this work as well as for manufacturing operations. Organic chemistry was only studied to a very limited extent before the war in Great Britain, and the services of chemists with organic training were largely required in munition factories. The company has managed to secure over 100 trained chemists, but it will be necessary greatly to increase this number, and certain educational schemes are now being developed. Arrangements were made with the University of Leeds for the company's chemists to attend, at its expense, a course of lectures on a branch of the chemistry of dyemaking. It has also been arranged with a local technical college, to which the company has given £5,000, that young assistants shall attend part time to receive chemical instruction. A much larger scheme is now being considered by a Committee of the Board.

The power-house, situated at the Dalton works, contains two 2,000-kw., 50-cycle, 3-phase, 3,000-r.p.m., 3,000-amp. per terminal Westinghouse turbo-generator sets, with provision for a third and larger set in the near future. The switchboards, switchgear, instruments, transformers, &c., are all of Westinghouse make. The whole of both the old Turnbridge and the new Dalton works are electrically lighted and motor-driven throughout, power at 3,000 and 400 volts being used with lighting to neutral. A large number of small motors are also used in the different laboratories. An underground ring main is ordinarily in use, but an overhead network is also provided as a stand-by in case of emergencies.

The present boiler system comprises 15 30 ft. by 8 ft. 6 in. Lancashire boilers. These are fitted with Hodgkinson coking stokers, Ronald Twist automatic feed-regulators and superheaters. The superheaters are by-passed to enable saturated steam to be supplied to the gas producers. Weir steam pumps are used throughout. All coal and ash is mechanically handled.

There are in course of erection six Stirling water-tube boilers, each of an actual evaporation of 25,000 lb. of water per hour at 200 lb. per sq. in. and 200 deg. superheat. These will be fitted with the Underfeed Stoker Co.'s forced-draught chain-grate stokers, induced-draught fans, and Crosby automatic feed-regulators. The coal and ash handling plant will be of Babcock & Wilcox make, the latter being of the suction type. Each boiler will be an independent unit having its own economiser of the standard "Green" type.

A boiler house to accommodate 16 30 ft. by 8 ft. 6 in. Lancashire boilers is in course of erection, to supply steam at 160 lb. per sq. in., which will be used for process work only, and will have only sufficient superheat to prevent condensation in the tubes.

In addition to the above plant, two similar batteries of boilers will be installed in other parts of the works. As far as possible the boiler houses will be standardised. Lancashire boilers are found to be particularly suitable for process work. This will be readily understood when it is considered that in one process alone the demand for steam may vary from nothing to 75,000 lb. per hour in 30 minutes. At the old works 24 Lancashire boilers are in commission; these are fitted with Bennis, Triumph, and Proctor stokers.

The power station contains two 2,000-KW., 3,000-volt, 50-cycle, 3-phase Westinghouse turbo-alternators with Heenan and Froude filters; two 1,250-KW. Westinghouse oil-cooled step-down transformers, 3,000 to 400 volts.; a 9-panel H.T. 3,000-volt cabinet type switchboard; and a 13-panel L.T. 400-volt board. Merz-Price protection on generator and transformer panels, overload on H.T. feeders, and parallel feeder protection on L.T. feeders is provided.

The steam turbines are constructed to work as pass-out machines, which enables steam at 30 lb. per sq. in. pressure to be available for process work, this arrangement giving a maximum thermal efficiency.

The condensers are of the plain jet type, water being taken from a local stream for cooling purposes. The installing of a further 5,000-KW. set is under consideration; this will be mounted over a standard surface condenser, water being supplied for cooling purposes by means of cooling towers. This new plant is urgently needed. It is interesting to note that the load factor is as high as 80 per cent., which compares very favourably with any other power station in the country. The overall cost of electricity is also very low.

The electrical system is 3,000 volts H.T., 3-phase, 50 cycles, stepped down to 400 volts L.T., 3-phase, 50 cycles, for works supply, and a 3,000-volt, 6-conductor, .25-sq. in. overhead line to step-down switchgear at Turnbridge, one and a half miles distant. The motors are 400-volt, 3-phase; lighting is at 232 volts, between phase and neutral. The H.T. generator neutrals are earthed direct, and the L.T. system is earthed direct at the power station and sub-station respectively.

The compressed-air plant, supplying air at 75 lb. per sq. in. to the works, consists of three electrically-driven belt-drive compressors, each capable of compressing 1,000 cu. ft. of free air per minute to a pressure of 80 lb. per sq. in, and two steam-driven compressors by Belliss & Morcom, each capable of compressing 1,000 cu. ft. of free air per minute to 80 lb. pressure. The exhaust steam from these sets is used in the gas producers.

The ice plant consists of four belt-driven compressors, two with 100-H.P. motors, and two with 45-H.P. motors. These are capable of making 60 tons of ice per day, and also pumping 24,000 gallons of brine at 32 deg. per hour. In the near future the size of this plant is to be doubled.

Distribution to date is effected at 400 volts from the power station and sub-station; 3 and 4-core paper-lead-covered cable is used, some armoured and laid direct, other plain lead in Sykes conduits. 300-ampere multiway Fluvent fuseboards of Parmiter, Hope & Sugden manufacture are installed as main distribution boards in each shed. At the Dalton works a radial system of L.T. paper-lead cables drawn into conduits has been adopted to feed the various sheds. An overhead ring main runs round the area, and is teed into each shed as a stand-by supply, and to equalise the load on the underground cables. Merz-Price protection is provided on the overhead ring main. The load on the system consists almost entirely of induction motors and lighting, with the exception of cooking installations at the canteen and chemists' club. The motor switchgear in all cases is totally enclosed, and provided with wiping glands to receive lead-covered cables.

The motors installed number about 400, aggregating 5,500 H.P., and there are about 5,000 lighting points. The generating station has an output of 10,000,000 units per annum.

CONFERENCE OF ELECTRICAL INSPECTORS OF INDIA.

From *Indian Engineering* of April 13th we abstract the following account of the proceedings of the third conference of Electrical Inspectors and Electrical Engineers to the Indian Government:—

Representations were made by the Electric Supply and Traction Federation of India, the Bombay Chamber of Commerce in conjunction with the Bombay Fire Insurance Agents' Association, and the local Electrical Contractors.

The main points brought forward by the Electric Supply and Traction Federation of India were:—

1. The obligation on the part of licensees to give a large supply to Government at a very low rate resulted in the public having to pay an enhanced rate in the same area, and thus it did not tend to stimulate industrial development in the area.

2. The local Government and local authority should undertake to support the undertaking from the commencement with a guarantee either of 5 per cent. interest or of a guaranteed larger consumption at a rate of supply not more than 10 per cent. below those fixed for general supply; and that when the supply company had paid dividends averaging 7 per cent. on its capital the surplus should be divided between the guaranteeing parties and the shareholders in the proportion of the guarantors' demand and the public demand for the past year. This arrangement to continue up to the time that the supply company paid 10½ per cent. on its capital after providing for depreciation, &c., when the local Government should be entitled to demand a reduction in the rates to all consumers, so as to bring the dividends down to an estimated 7 per cent. again, when the same process of dividing surpluses would again continue.

3. The necessity of allowing each electrical inspector more discretion and authority to relax rules, and the establishment of a Court of Appeal to which licensees might apply in the event of an inspector giving a decision which the licensee considered unreasonable.

The deputation from the Bombay Fire Insurance Association, the Bombay Chamber of Commerce, and the British Cable Makers brought forward two points, one being the labelling of wires and cables, and the other the registration of wiremen and wiring rules. The deputation urged on the conference the necessity of advising the Government of India to introduce such legislation as might be necessary to make it compulsory that all wires and cables imported into India should have a sealed label giving the manufacturer's name, and details of the size, grade, and class of wire, and also that it should bear some distinguishing marks to make it possible to identify any wire or cable after it had been fixed in position. The deputation recommended to the consideration of the conference the necessity of having one set of wiring rules, and the registration or licensing of all wiremen and electricians. They pointed out some of the main defects commonly found in installations which were due to inferior workmanship.

The deputation of Electrical Contractors brought up a minor point regarding the importation of foreign fans.

The report of the conference dealt with questions of law and interpretation, and amendments to the Indian Electricity Act, 1910; the Indian Electricity Rules, 1911; the "Model Form of Conditions, Rates, and General Information for the Supply of Electrical Energy" which had been previously circulated by the Government of India to all local Governments and licensees, inviting criticisms and suggestions; the Model Wiring Specification which was drafted early in 1917, and which was circulated to all members of the conference, the Electric Supply and Traction Federation, and the Calcutta Local Centre of the Institution of Electrical Engineers; and technical papers read by members of the conference. On the whole, the report contains very little of importance; the points raised by the Electric Supply and Traction Federation of India form the bulk of the discussions.

As regards the licensing or registration of wiremen, the conference and the Federation agreed that action on the general lines of the reports of the meetings in 1916-17 should be taken in each province, industrial facilities in the way of classes being the main requirement as a preliminary to certificating or licensing. It was mentioned that in Madras such classes had been instituted by the Director of Industries. The rules relating to the grant of certificates are printed in an appendix to the report. The standard required is high, and is a move towards eliminating "jerry-wiring."

Two papers were read by Mr. Meares, one entitled "Notes on Indoor Illumination," and the other "Types of Ceiling Fans, with Effective Area and Consumption." A paper on "Ferro-Concrete Poles" was read by Mr. Greenwood.

MR. DUDLEY DOCKER AND THE ELECTRICAL INDUSTRY.

The Metropolitan Carriage, Wagon, and Finance Co., Ltd., held its annual meeting at Birmingham, at which it was resolved to increase the capital of the company to £10,675,000 by the creation of 7,000,000 new ordinary shares of £1 each. We make the following extracts from an important speech delivered by Mr. F. Dudley Docker, C.B., the chairman:—

I told you last year that we had embarked on electrical business, and that we had purchased from the Americans the control of the British Westinghouse Co. You will, I know, agree that the electrical trade is a "key industry," and to be successful it must be organised on broad and sound lines. In the past it has been almost entirely controlled by other nations, and that because there were too many competing interests in this country, each suffering from insufficient equipment. It is our intention to strain every nerve and to use to the full the resources of brains and capital to build up this industry. We are certain it will not only be to the ultimate good of the shareholders, but a matter of considerable importance to the country itself. In pursuing this enterprise we feel that we are helping the whole of our national commerce, and as we are in a position to do so, we have no hesitation in asking you to be generous in your support, to take the broad view, and to study the national as well as our individual interest.

I am convinced that upon electrical enterprise rests the fate of nearly every industry in the country, and I do not doubt that in various degrees our policy will have the support of the whole commercial world. After the war we shall have the keenest competition from Germany, and I have had some particulars taken out as to the amount of money spent on research in the past by our enemies, and I think I am right in saying that it is almost, if not quite, in excess of the whole of the dividends ever paid in this country by the whole of our electrical industries. It is our intention to have a research department that shall be second to none in the world. We mean to cast our bread upon the waters, and we hope for a reward that will not be too long delayed. To strengthen the position we have entered into an alliance with Messrs. Vickers who will share with us in our electrical work. In addition we have recently acquired large interests in the South Metropolitan Electric

Light and Power Co. and the West Kent Power Co., both of which have areas ripe for development.

I would remind you that your company has in the past devoted a vast amount of time and attention to the electrification of railways. The provision of equipment other than the actual construction of the necessary rolling stock has always been a difficult one. The enterprises in which we have acquired interests will enable your company to undertake the whole work of electrifying a railway, even to supplying the power. This is a great step forward, as in the past some of this work had to be shared with the foreigner.

At the outbreak of war the manufacture of glass bulbs for electric lamps had been almost exclusively done abroad. I am glad to say that, in conjunction with the General Electric Co., we have agreed to purchase the British rights in special machines for making these glass bulbs, and we hope soon to have the first machine installed and at work, when Great Britain will be independent, as far, at any rate, as the manufacture of these bulbs is concerned. We do not, however, seek to establish any monopoly, but will be ready to grant licences on favourable terms to any British firms. The chief object of our developments has been to ensure self-support to this country in trade and business that in the past has been, in some degree, controlled by other nations. I want you to lay hold of this fact, and I am happy to say that others, too, are looking ahead in the hope that when our long-delayed victory in the battlefield is crowned by a lasting peace, we shall be found ready to take our proper position in the industrial competition that is certain to follow, and hold a winning place.

You will remember that from time to time I have drawn the attention of the public to the imperative necessity of amalgamations and combinations, and I have been glad to see in recent times much progress in this direction. That combination of large firms like the Workington Iron Co., Steel, Peech & Tozer, Frodingham. Samuel Fox & Co., and others, is, to my mind, all to the good. Some people have given voice to their fears that these amalgamations are merely a creation of trusts, which in time secure monopolies to the detriment of the public weal. I have no such fears, and, within reasonable limits, I am wholly in favour of combining competing interests. I think the success of this company is a standing tribute to the wisdom of amalgamation carried out on sound lines. I willingly concede that it is quite right to discourage the creation of monopolies, but that is a very different thing from the combining of persons in particular trades, to do away with such throat-cutting competition among themselves as leaves them—good, simple folk—an easy prey to the foreigner, and forces them to cut down the wages paid to their own employés. You must remember, above all, that it is with Germany we shall principally have to compete after the war; that in Germany the policy of combination has been reduced to a fine art, and that it is against Germany in particular that your board intend to wage implacable war until the conditions that stifled British trade in the past have been rendered impossible of revival. I emphatically declare that amalgamations and combinations aiming at the elimination of unfair home competition and its consequences are entitled to, and may well demand, support in the interest of the British race. These combinations not only secure trade to the nation, but also provide abundant supplies to the public of the articles they want of a good quality, and at a lower cost. In addition, they ensure a fair profit for the partners, and, what is more, good wages to be paid to the workmen. If we are going to keep our place in the markets of the world we must be strong, and strength can only be gained by combination of effort and resources. Let us, then, help ourselves; let us shake off our shackles and strengthen our muscles, and then when we have to compete with our rivals the country must see to it that we get, as of right from our Government, abundant Imperial support in a definite and organised manner, and not in the sporadic and haphazard fashion that has paralysed our efforts in the past.

Two years ago I mentioned to you the formation of the Federation of British Industries. At that time I told you we had among its members a number of influential firms, but that we wanted a thousand. I am happy to tell you that we are well on the way to that thousand, as the latest return that I have seen shows that the membership, including trade associations, was between 800 and 900. I am glad to tell you that this Federation is consulted by various Government Departments, and I believe, as time goes on, it will have great weight in all deliberations on trade affairs. I do hope that other firms will, sooner or later—and the sooner the better—become members, for, though we may have differences of opinion, we are all out for the one big thing, and that is the British side; and we can only accomplish results by being united and by ventilating whatever grievances we may have one with the other before going out to battle. This Federation should have far reaching benefits for every member of the trading community.

Insulating Material from Fish Offal.—A new Danish process by which certain by-products, valuable for electrical insulation, may be made out of fish offal, is soon to be put to practical test in Skagen, Denmark. The most important of the new products is called "cornimit," and a factory known by that name is now being erected. It is claimed for "cornimit" that it excels galalith as an electrical insulating material. It is said to have less water-absorbing ability, as well as a larger insulating resistance. The price of the finished product is calculated at 11d. per kilo (5d. a lb.).—*U.S. Commerce Reports.*

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

8,372. "Electric ignition tube or plug." J. W. Paterson. May 21st.

8,381. "Means of igniting charge of liquid fuel in internal-combustion engines." E. H. Salmon & J. R. Wass. May 21st.

8,382. "Ventilation and cooling of dynamo-electric machines." C. W. Major. May 21st.

8,336. "Magnetic healing apparatus." S. Maeshima. May 21st.

8,397. "Apparatus for military telegraphy to avoid overhearing by listening apparatus." A MacArtair. May 21st.

8,447. "Support for telephone receivers." A. E. Ford. May 21st.

8,476. "Electric arc welding systems." T. G. McKay & H. Pollock. May 21st.

8,492. "Electro-magnetic clutches" W. Langdon-Davies & A. Soames. May 22nd.

8,505. "Electric lampholders." A. H. Short. May 22nd.

8,509. "Electric furnaces." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 22nd.

8,529. "Apparatus for electrical separation of substances in suspension in gaseous or fluid media." Soc. Gallot et Cie & Soc. Poussin Rondeux et Cie. May 22nd. (France, May 22nd, 1917.)

8,538. "Apparatus for regulating strength of electric currents for medical purposes." M. Nicoletis. May 22nd.

8,573 "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 23rd.

8,547. "Electric motor control." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 23rd.

8,581. "Trolley heads for electric tramways, &c." J. G. Small, A. G. H. Thatcher, and Wadkin, Mills & Co. May 23rd.

8,607. "Electric hand-lamps." J. Bein. May 24th.

8,621. "Direct-current and dynamo-electric machines." B. J. Shillito and H. Wallwork & Co. May 24th.

8,623. "Apparatus for measuring and indicating electricity supply." L. R. Lester. May 24th

8,639. "Electric induction apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 24th.

8,640. "Electric conductors." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 24th.

8,644. "Dynamo-electric couplings" A Gossweiler. May 24th. (Germany, May 29th, 1917.)

8,646. "Shade carriers." C. G. M. Bennett. May 24th.

8,664. "Multiple telegraphy." F. J. Mackenzie. May 24th.

8,669. "Telegraphy" J. S. Withers (K. C. Cox). May 24th.

8,699. "Condensers for magnetos." A. H. Midgley & C. A. Vandervell and Co. May 25th.

8,702. "Sparking plugs for explosion engines." Soc. Ceramica Richard-Ginori. May 25th. (Italy, August 16th, 1917.)

8,707. "Gas and electricity economiser." J Williams May 25th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

18,388 Induction Furnaces. Ajax Metal Co. January 24th, 1916. (103,645.)

1917.

1,588. Electric Furnaces, and Transformers for use therewith. British Electric Transformer Co. & F. E. Berry. January 31st, 1917. (115,247.)

1,674. Electric Furnaces for Melting or Refining Non-ferrous Alloys. V. C. Faulkner. February 2nd, 1917. (115,248.)

4,341. X-ray Localisation. J. M. Davidson. March 26th, 1917. (Cognate application, 10,325/17.) (115,251.)

6,132. Electric Cut-out or Protective Arrangements for Electrical Systems. W. J. John & J. John. May 1st, 1917. (115,263.)

6,343. Combined Electric Switches and Couplings. W. Donovan & G. O. Donovan. May 4th, 1917. (Cognate application, 8,585/17.) (115,275.)

6,530. Electric Cables containing Several Conductors. Pirelli & Co. June 28th, 1916. (108,464.)

6,542. Electrical Signalling Systems. Sterling Telephone & Electric Co. F. G. Bell & W. C. Davey. May 8th, 1917. (155,280.)

7,185. Electrical Condensers. Dubilier Electrical Syndicate. May 2nd, 1916. (107,002.)

7,191. Electric Motor Control Systems. W. Brooke. May 18th, 1917. (115,301.)

8,300. Switch-controlling Means for Electric Lampholders and like Coupling Devices. G. St J. Day. June 11th, 1917. (115,318.)

8,318. Electrical Switch Apparatus. E. Goldston & E. W. Wood. June 11th, 1917. (115,129.)

9,759. Machines for Covering Wires and the like. C. J. Beaver & E. A Claremont. July 5th, 1917. (115,331.)

9,811. Multipolar Magnetos for Electric Ignition Systems. W. J. Mellersh-Jackson (Bosch Magneto Co.). July 6th, 1917 (115,147.)

9,953 Protective Devices for use in Systems of Electric Distribution British Thomson-Houston Co. (General Electric Co., U.S.A.) July 10th, 1917. (115,334.)

12,473. Electric Bells. E. A. Graham. August 30th, 1917. (115,173.)

14,171 Thermal Circuit Closers. A. M. de S Greaves. October 1st, 1917. (114,975.)

14,286. Process for the Electro-deposition of Base Metals. A. A. Lockwood. October 3rd, 1917. (114,976.)

15,272. Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) October 20th, 1917. (115,370.)

15,419. Electrical Switches, Fusible Cut-outs and the like. V. G. Middleton & C. J. Baker. October 23rd, 1917. (115,373.)

15,815. Electric Accumulators. H. Dean & Chloride Electrical Storage Co. October 30th, 1917. (115,374.)

16,008. Electric Transmission of Music. M. Tocchio. November 2nd, 1917. (114,987.)

16,074. Prismatic Glassware for Illuminating Purposes. Holophane, Ltd. (Holophane Glass Co., U.S.A.) November 3rd, 1917. (114,988.)

16,265. Distributors for Magneto-electric Machines. British Thomson-Houston Co., A. P. Young & H. W. H Warren. November 7th, 1917. (115,375.)

16,279. System of Electric Regulation for Variable-speed Dynamos with Parallel-connected Storage Batteries. Akt. Ges. Brown, Boveri et Cie. November 11th, 1916. (111,477.)

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PRODUCTION DATA IN WAR-TIME.

SOME of the commonplaces of war-time in which we are prone to find relief for vexation and pent-up feelings of irritation are aimed at the infringement of individual liberties, at Governmental control, and at the multiplicity of statistical returns that we are called upon to render. We are conscripted in the present for the grand purpose of preserving for the foes of Prussianism the ultimate freedom which we regard as the heritage of democratic peoples. Temporarily we suffer what we may comprehensively term inconvenience, in the fixed determination that threatening shackles shall never bind us permanently. We offer our criticisms and our protests concerning "interference," inquisition, excessive tabulation, and so forth, because we must somehow give vent to the feeling that we are living in the most impossible of worlds, yet deep down we recognise that we are in the throes of a war which inevitably cuts right to the heart of everything, and places upon us burdens of change in regard to established systems at home, just as it changes absolutely the lives of millions of fighting men. Not that we would condone in the least degree the desires of men in authority to be officious and unduly inquisitorial, increasing our work and strain unnecessarily when experienced men are away; but we have respect for the view that for nations that have during a long period developed their methods individually, and more or less evolutionarily, the change-over to co-ordination and maximum mass efficiency for the purposes of war must impose conditions that under normal circumstances would never have been tolerated in imagination, much less borne in actual practice.

In pre-war days, when each manufacturer in an industry was free to "gang his ain gait," some were content with out-of-date methods so long as sufficient business could be secured to ensure a certain profit. If such methods were clung to tenaciously and too long, and the competition of modern operation and high efficiency was encountered, a process of reorganisation, liquidation, or reconstruction threatened. Those who faced the situation thoroughly and in good time, managed to revitalise their concerns by the adoption of new principles, new equipment, and systematic observation and control of manufacturing costs—in short, by ensuring that Capital, Labour, management, and equipment were all so employed as to secure the maximum of efficiency at the minimum of cost and with the minimum of friction. Individual manufacturers naturally arrived at different results—there could not be uniformity in geographical conditions, purchase, or selling conditions; many, and sometimes all, of the contributing factors differed. In open competition tenderers were able to see something of each other's ability, and each strove, in the absence of "understanding" between them, to secure a piece of business, perhaps undercutting or accusing somebody else of doing so, and wondering how on earth such production results could be arrived at. Each manufacturer got to know a little about the inner operations of the other's offices and works—perhaps by fair means, perhaps by subterfuge, to use a euphonious term. But there was always the incentive remaining to strive after higher efficiency, to secure improved results, by some means or other. Every manufacturer guarded his own purchasing, operative, and production data, as secrets to be preserved inviolate from the curious eyes of others engaged in the same section of industry. In this he was doing little more than the ordinary man of trade. The custodian of capital, whether his own, his relatives', or his shareholders', he had to safeguard that capital, and to ensure a return upon it, and if in the progress of manufacturing or trading special experience had been purchased which could not be gained in any other way, that was the peculiar property of his concern, which could not be divulged to anybody but those who were interested in making that business a success. We may criticise this attitude when we try to take the wider view of things that must characterise our study of national industry as a whole, but we must recognise that along such a course lay the path to individual efficiency and success. To-day, when we are faced with problems of future production involving mutual understandings which amount to combinations, amalgamations, or co-ordination of interests, we may not be so enamoured of the policy of individual action, because we anticipate that a large number of isolated concerns cannot hold up against the combined assaults of scheming Continental industrial organisations or trusts which possess all the advantages of consolidated effort. Yet, however far we may carry the idea of combination of interests, the fact still remains that the efficiency, enterprise, and initiative of the individual unit will be as necessary as, or more necessary than, they ever were in the past.

One of the secrets of success in the combined organisation of the future will be the safe utilisation of all these isolated cases of individual efficiency for the best interests of national industry as a whole, without unnecessarily damaging the value of any of the concerns. Everybody, we think, sees the necessity for the great and strong combination—we hope for gratifying results to accrue, in due course, from some of those already established during the war. But nobody supposes that engineering industries are going to fall into a few settled groups and everybody else will go to the wall—that would be a sheer absurdity. The "small manufacturer" (what capital or turnover do we imply by that expression in these days?) will always fill a considerable place in British, American, and Teutonic industry, and the life and energy of some of them in their operations to-day show that they intend to do so.

Notwithstanding all this, however, there are changes coming over industry as a result of the ownership of numerous war-time factories by the Government, and as the outcome of Government control of thousands of other works in and out of the electrical industry under the Munitions of War Acts. The possession of secrets concerning manufacturing costs in individual factories, to which we have referred above, has been materially affected. Whereas, in the old days, such data were the exclusive property of the holder, they are not so to-day, for though manufacturers themselves do not indulge in an exchange, there is a mass of material in the hands of the Ministry of Munitions and of the Dilution Branch of the Ministry of National Service which may be of wide-spreading effect in the establishment of standards for labour, cost, &c. It is not conceivable that material of such a kind, and on such a scale, would ever have been brought together by British manufacturers acting voluntarily. Only under war conditions and under State operation could it be possible. The subject has been alluded to in several technical engineering journals recently, in connection with a valuable paper which was read before the Institution of Mechanical Engineers early in May by Mr. B. H. Morgan, who for two years was Technical Adviser to the Labour Supply Department of the Ministry of Munitions, and who to-day is in charge of another Department, where the material accumulated will be of inestimable value in assisting the manufacturers to attain to high standards of efficiency of labour employment and of production at a time when the military call upon their labour is becoming more pressing than during the whole period of the war. The paper is entitled "The Efficient Utilisation of Labour in Engineering Factories—with Special Reference to Women's Work," and the discussion that has taken place upon the subject shows that the engineering world is alive to its importance not only because of the emergency of the moment and the need for us to adapt ourselves to all that it involves in the way of dilution, but also on account of the after-war effect which the tabulation of labour and production data in industry on a large scale is likely to exercise upon our whole manufacturing position, assuming that the data collected and the standards evolved under conditions governing war-time production can be applied in some manner to private industrial operations. We hope to return to the subject in further detail.

Industrial Problems.

On two occasions this year, Mr. F. S. Button, of the Committee on Production, has contributed to a discussion at the Engineers' Club, Manchester, on the subject of Whitley Committees. The remarks made by him at the resumed discussion in March have been printed in pamphlet form, and copies can be obtained (4d.) from the Hon. Secretary of the Club, Mr. H. Richardson, Albert Square, Manchester. It is not unusual for speakers who endeavour to popularise the Whitley idea to be criticised for vagueness or want of definiteness as to the manner of applying the principles to a particular trade. Mr. Button apparently shared this experience, and so in March he returned, by invitation, to elaborate his ideas for applying the Whitley proposals stage by stage. His synopsis includes the setting-up of four separate, yet interdependent, bodies:—The Works Committee; the Central Works Council; the Local District Council; and the National Industrial Council. The matter is, in our estimation, one of extreme importance, and we hope that those who are taking a real interest in the question and its bearing on our particular industries will secure a copy of the pamphlet. In some supplementary observations on the subject of arbitration, Mr. Button said that if Capital and Labour gave the Whitley scheme a fair trial, greater productivity in the workshop must inevitably result. He thought it might well be that a more scientific method of adjusting wages to output might be evolved, and as the problem of production was solved, so the problems and methods relating to distribution might equally have brain power plus humanising agencies applied to them. Mr. Button suggested that the old-fashioned machine of the lock-out and the strike on wages questions be scrapped, and periodical revisions by methods of arbitration take their place. He predicted that in the future the settlement of wages questions would be affected by such considerations as the variations in the cost of living, increased output, market prices for the article produced, the state of trade, and gold values. Employers and employed may not agree to any form of arbitration on technical questions requiring great knowledge and experience of the trade concerned, yet we are faced with the prospect that in future industrial conflicts will rage largely for the control of industry itself. During the past month or two voices have not been so insistent in demands to that end, probably because the German offensives have overshadowed everything else, but the demand will come later with full force, and in preparation for the coming years we should be taking measures for "granting a real constitution to every industry"—"a constitution which will enable Capital and Labour to reach, on a mutual basis, the points on which their interests harmonise, and then to extend the system until the parties coalesce." Only by such action, taken in good time, can we, in the opinion of Mr. Button, prevent "Armageddon."

Mr. G. H. Roberts, Minister of Labour, in one of his latest utterances has shown that he is under no delusion respecting the troublesome times that will follow the war. He was alluding, we believe, more particularly to troubles outside these islands and in connection with trade. Such considerations only lend emphasis to the appeal for friendly relations between all industrial parties at home; but no appeals will avail unless we take definite preparatory action.

Attention may profitably be directed to an article appearing in the *Board of Trade Journal* for June 6th relating to the provisions of the Chambers of Labour Bill, a Government measure which is now receiving attention in the Reichstag. The writer makes a comparison between the proposed Chambers and the Works Committees which have existed in Germany for many years. It appears that until December, 1916, there was no obligation of any kind to establish a Works Committee in any industrial concern, but at that date it was made compulsory in all such concerns engaged in work of national importance, and in which 50 or more workpeople were employed, for Works Committees to be constituted and permanently maintained. These Committees are intended to promote harmony amongst the workers themselves and between them and the management, and the Committee has to bring before the management the "proposals, wishes, and grievances of the workers relative to the conduct of the concern, to the wages and other labour conditions, and to the general welfare of the business," and to express its opinion thereon. The direct and secret ballot are employed, based on principles of proportional representation from the workpeople, and similar provision is also made in respect of the salaried staffs. The *Journal* sets forth the full details of the Chambers of Labour Bill proposals, the functions, composition, constitution of the Chamber, &c. It is not pretended that the Works Committees referred to meet the needs of Labour; no meeting, save of a preliminary kind, can be held unless under the chairmanship of the employer or his representative, and he conducts the discussions.

The promotion of healthy relations between masters and men—in other words, "fostering industrial harmony"—the initiation of measures to improve the position of the workers, "especially of the rising generation," co-operation in collective labour agreements, to establish employment exchanges, and to co-operate in finding employment for wounded and invalid soldiers, and for others out of employment owing to the war—these are some of the special functions of the proposed Chambers. The Bill has been subjected to a good deal of criticism, especially from the *Vorwärts*, as reference to the *Journal* will show. We have given so much attention to after-the-war Labour conditions in this country, and the preparations that should be made for that period, that it is unlikely that we can learn anything from Germany which will be reproducible in the very different conditions that prevail, or may prevail, here. But we are sure that those interested in the subject will not consider wasted any time devoted to a study of the German proposals.

Cui Bono?

It might have been supposed that some of the experiences of the past four years would have had a restraining influence upon some energetic spirits who are eager to throw stones or to stir up mud. Several prosecutions in the Courts have demonstrated that not all minds are as well balanced as they might be; let us charitably attribute the malady to long-continued war strain. We prefer to credit men with higher motives than their actions suggest, though the old Scriptural quotation about knowing men "by their fruits" is a fairly safe guide as a rule. It is unfortunate that even to-day there are amongst us men who are not unwilling to employ some of the loftiest of a people's aspirations and the most high-scunding phrases in the interests of noisy propaganda. We may have a laudable contempt for the man whose musical tastes can only be gratified by the beating on a big drum, or for the tub-thumper whose oratory at the street corner merely shocks our presumptions to refinement. Wearing their shibboleths inscribed upon their swelling breasts, perhaps in mocking semblance of Pharisaic phylactery, they boost their own reputations by thanking the Lord that they are not as other men are. When we recall that it is written of such that "they have their reward," there is something within us which whispers curiously inquiring what the exact nature of that reward may be. What are the ends that they have to serve by casting reflections haphazard upon others whose convictions are quite as sound as their own, though their emotions and their vituperation may find expression with greater calmness and good judgment? Perhaps it is a thing for which to be profoundly grateful that all men are not cast in the same mould. Perhaps, too, it would be better if we recognised that such variety is as unalterable as the laws of the Medes and Persians; then we might find other ways of attaining the best ends. For ourselves, we prefer the man who, if he has something to say, will deliver himself openly. But there are those who prefer to spread their thoughts by means of insinuation in secret conclave assembled, or in converse on the lone byeway, where those they seek to malign will be out of ear-shot. The best interests in any cause will never be permanently secured by means of such devices.

It is not always what others "have done"—sometimes it is what they are *said* to have "left undone"—that induces the insinuator to suggest that there is "no health" in the object of their attack. It is so easy to know another man's business better than you know your own!

Surely, if the heart of the British nation is sound, and that of British industry beats true, we can afford to deport ourselves more worthily and with greater dignity along a higher plane. If ever there was a time when the clarion call was in the ears of all to close our ranks, to cast out petty suspicions, to abandon the slavish pursuit of personal interests, "taking a rise" out of everybody else, and face in unity the coming of new conditions which will require the best from all of us, that time is now!

Electrical Engineers' Associations.

Last week we were able to report progress towards the formation of the Electricity Supply Section of the Association of British Electrical Engineers, which was unanimously supported by the Newcastle Local Section of the I.E.E. at a "mass meeting" of those interested in that neighbourhood. In the same issue we gave particulars of the comprehensive objects of association of the Electrical Power Engineers' Association, which will commend themselves to all who are eligible for membership, and which certainly constitute an ambitious programme. It will be noted that Mr. Wordingham is in communication with the promoters of the E.P.E.A., with a view to arriving at an understanding between the two bodies, a matter of the first importance. A letter in our "Correspondence" columns to-day indicates that the E.P.E.A. claims to cover the same ground as the embryo Association, and the position is full of difficulty, which will tax the ingenuity of the President of the Institution to surmount. Our hope is that a satisfactory solution to the problem will be found, for the continued existence of two organisations with similar objects and cultivating identical fields would represent a deplorable miscarriage of the principle of co-operation by which we must be guided in all our undertakings.

We publish elsewhere in this issue particulars of the new movement inaugurated by the British Engineers' Association, which already includes in its Section "A" manufacturing firms, in Section "B" allied concerns, and now is forming Section "C" to consist of individual engineers and others connected with engineering. This new Section also comes into existence with influential support, as would be expected from its parentage, evidently having the approval of the three great engineering institutions. The objects of the section are set forth in our "Notes," and are in every way praiseworthy. In this connection we may draw attention also to the "Manufacturers' Section" of the Association of British Electrical Engineers, foreshadowed when the "Electricity Supply Section" was set on foot, and now, we believe, in process of formation. The purpose of this Section, like that of the "Electricity Supply Section," is to provide the members—technical men in the manufacturing electrical industry—with a strong Association for the purpose of collective representation in matters concerning their welfare; its proposed organisation is also on similar lines, and it will be registered as a Trade Union in order to secure the necessary legal status, though, of course, its policy will be defined on unobjectionable lines.

Every one of these significant movements deserves our heartiest support, though their number is somewhat bewildering and their objects are apt to overlap; for instance, the whole of the members of the "Manufacturers' Section" of the A.B.E.E. would doubtless be eligible for membership of the "C" Section of the B.E.A., but the converse would not hold good. Our readers may be expected to enter a protest against the multiplication of alphabetical conundrums with which they are confronted every week, and our only excuses are that it is not our fault, and that space is precious. But does it not appear that some collective action should be taken to co-ordinate the efforts that are being made to organise these new Associations? There is a real danger that they will be weakened by their very multiplicity if the process of creation of new Associations is permitted to go on uncontrolled much longer.

COMPUTING THE SPEED OF RECEIVING A TELEGRAPHIC MESSAGE THROUGH SUBMARINE CABLES.

A Universal Method.

By J. RYMER-JONES.

In a pamphlet published by the Electrical Review office in December, 1911, the writer explained a method having the above object, the novel and important characteristic of which is that of *counting* all the elements which constitute the letters, or numerals, occurring in the part of the received message dealt with, instead of giving to all letters the same mean number of elements (e) based on 1,000 or more words found in newspaper paragraphs, as has hitherto been a common practice; but which has not even the recommendation of applying *equally*—albeit incorrectly—to very short or long messages, code words, groups of numerals, or foreign languages.

Owing, however, to the writer having dealt rather widely with the subject in the above-mentioned pamphlet—by including a comparison between the International and U.S. of America Morse alphabets—their mean elements per letter (e), or per word of 5, 7, or 10 letters, their relative speeds, the recurrence per cent. of all the letters in the alphabet in the case of different kinds of messages, a table of *constants* for reducing e.p.m. to w.p.m., and other considerations bearing on the subject—the speed method itself has, it would seem, in some measure been eclipsed, and made to appear rather formidable, whereas it is really very simple, and quickly effected with the assistance of Form A.

From letters received the writer is glad to know that the principle of *counting the elements* in the letters of the part of the message dealt with has been appreciated by several interested in finding a more satisfactory and common basis for comparisons than adopting an assumed average number of elements (e) per letter, as referred to above.

One correspondent writes: "I have just been re-reading your brochure on 'Method of Computing Speed of a Telegraphic Message.' This is very valuable, as, so far as I know, it is the only published 'count' of signalling elements in existence."

It has been suggested that a shorter statement dealing only with the method itself would make its simplicity and advantages more obvious.

This the writer would preface with the remarks that its simplicity is due to the fact that *in principle* only *one word* is sufficient from which to evaluate the speed, though in practice it is better to select five or six words (see example in Form A); and that not only does the method apply to automatic sending, but it has another and special value for hand-transmission, because it puts the latter system on the same satisfactory basis in this respect as the former, since it makes the calculated result independent of *unequal* spaces, due to hesitations or "rub-outs," by making a proper allowance in the formula for the recognised number of space-elements between words.

Specimen Signals.—As the characteristics of long cable signals differ greatly, and as the number of elements, or words, receivable per minute must depend to some extent on the expertness of the receiving operator, it is generally understood that the standard of legibility to be maintained is such that the definition of signals at the rate reported for the speed-trial should not be misread by any of the ordinarily qualified clerks, who are familiar with that particular circuit, during a reasonably long stretch.

On this account, therefore, affixing specimens of signals to the daily returns of speed-trials furnishes the best criterion of their relative quality; to what extent the level of excellence is being maintained in the adjustments; and evidence that the speed reported is not to be attributed to the special expertness of the clerk in deciphering difficult signals; but that they are fully up to the specimen preserved as a standard for comparisons.

Elements per Minute (e.p.m.).—This basis is itself a perfectly satisfactory standard of comparison, applicable to all kinds of telegraphic messages, in all countries employing the siphon recorder or Morse recorder, because expressed in terms of the same definite and universally understood unit, viz., the *element.*

It is only when the *elements per minute* are reduced to l.p.m. or w.p.m., that uncertainty and confusion often arises as to the precise value of the *letter or word.* In order to prevent a *definite* being converted into an *indefinite* value, what is wanted is either to state the e.p.w. employed, or to adopt a generally-agreed-to number of elements per *standard letter*, or per *standard word* of n letters, including a proportionate allowance for space-elements between letters and words: then—*provided that the actual elements constituting the selected part of the message be counted*, as shown in Form A—this adopted *constant* in elements per letter, or per word, will enable anyone to correctly convert speeds expressed in l.p.m., or w.p.m., into elements per minute; which, as already stated, has only one meaning, whether the message be short or long; code words or groups of numerals; in English or any other language.

E.g., in the formula for speed in w.p.m., the *numerator* $N = E/T = [L\,e + s(L - W)]/T$ = elements per minute: *i.e.*, the total elements in the letters of the words selected for a speed-trial, together with a proper allowance of space-elements between letters and words, divided by the time (T minutes) during which it was recorded.

The denominator (D) expresses the elements per standard word of n letters, also including the proportionate allowance for spacing between letters and words—*i.e.*, $D = e \times n + 3(n - 1) + 7(W - 1)/W$ elements.

The number (n) of letters per word is generally stated, but the uncertain quantity in the denominator (D) is the value (e) elements adopted per letter.

Moreover, the expression $7(W - 1)/W = 7$, provided that the part of the message dealt with consists of *many* words; but if it consists of only six words, as in the example given in Form A, then the number of words (W) and of letters (n) per word are required in the denominator, as well as the questionable number of elements for e. These two possibilities of error, but more especially the value of e, account for the uncertainty often attaching to speeds merely expressed in words (of so many letters) per minute without stating also the particular number of *elements per word.*

The principle of counting the actual elements constituting the letters of a few selected words in the message; calculating (in the manner described in Form A) the time of receiving those words; and computing from these two data the speed of recording the message in e.p.m., is equally suitable for very short or long messages; for short or long code words; for numerals; and also for messages in any foreign language capable of being transmitted in the International, or U.S. of America, Morse alphabet, and received on the Morse instrument or siphon recorder. Moreover, if the absolutely definite *element* is adopted as the basic unit in which to express speed of signalling through all cables, it may fairly be claimed that this method is capable of *universal application* to all submarine cables.

The relative working of the same cable from day to day is conveniently expressed in e.p.m., while the speed-rate *constant* * when expressed as KR × e.p.m. should correctly express not only the efficiency of that cable, but its efficiency as compared with that of any other cable whose KR × e.p.m. are known.

Therefore, if plotted daily on a curve sheet, the speed-rate *constant* will correctly indicate at a glance the effective working—*i.e.*, to what extent any cable is daily realising the rate of output which its KR permits of when compared with the best-recorded performance of any other long cable, worked under the same conditions.

Re Elements per Letter and Constants.—A considerable error may enter into the numerator of the old speed formula on account of the number of elements (e), adopted as representing an average letter for the whole message, really varying greatly in different kinds of messages. This source of error is entirely eliminated by employing the method recommended by the writer—*i.e.*, *counting the actual elements in all the letters (or numerals) which occur in the message*; adding a proper number of elements for spaces between letters and words, and reducing these elements to elements per minute. If this be done, then any error which arises when reducing elements per minute to letters, or words, per minute will be entirely due to the *constant* (*i.e.*, denominator of the formula) not being suitable.

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* Expressed by Dr. Muirhead as the KR × speed in w.p.m. See "Speed Standards and Circuit Efficiency," by Edward Raymond-Barker. Munro and Jamieson's Pocket-Book Edit. 19, p. 350.

The writer has given later on some *constants* for reducing

FORM A.*—DATA REQUIRED FOR CALCULATING THE SPEED OF A MESSAGE.

Number of Letters and Numerals (L) = 41 Words (W) = 6 Date:..............

Message. " Speed of telegraphing through submarine cables "

$$\text{Speed of working} = \frac{\dfrac{\overbrace{Le + s(L-W)}^{E}}{T}}{\ddagger Ew_1 + s_1\left(\dfrac{W-1}{W}\right)} = \frac{\text{Elements received per minute}}{\text{Elements per standard word including space elements between words }(Ew_2)} = \text{standard w.p.m.}\dagger \text{ of } Ew_2 \text{ elements}$$

Columns in Table I

$$,, \quad = \frac{\dfrac{179 + 3(41-6)}{0{\cdot}2864}}{32{\cdot}18 + 7\,\dfrac{6-1}{6}}$$

$$,, \quad = \frac{991{\cdot}5}{39{\cdot}18} = 25{\cdot}3 \text{ Standard w.p.m. of } 39{\cdot}18 \text{ elements.}$$

						Number of elements.											
						International code.						U.S. of America and Dominion of Canada					
						Syphon recorder	Morse recorder or sounder.					Morse recorder or sounder.					
						A	B	C	D	E	F	G	H	I	J	K	L
Space (longer§) in spaced letters.						—	—	—	—	—	.	3	3	2	2	2	2
,, (s) between letters of words.						3	3	3	3	2	2	5	5	5	3	5	3
,, (s₁) ,, words.						7	7	5	5	5	3	7	7	7	5	7	5
Value of ordinary "dash."						1	3	3	2	2	2	3	2	3	3	2	2
,, letter L.						—	—	—	—	—	—	5	3	5	5	3	3
				Letters & numerals l	Elements l×A	A.											
A	a	///		3	9	3	5	5	4	4	4	5	4	5	5	4	4
—	ä					7	11	11	9	9	9		—	—	—	—	
B	b	//		2	14	7	9	9	8	8	8	9	8	9	9	8	8
C	c	/		1	7	7	11	11	9	9	9	7	7	6	6	6	6
D	d	/		1	5	5	7	7	6	6	6	7	6	7	7	6	6
E	e	𝍸	/	6	6	1	1	1	1	1	1	1	1	1	1	1	1
—	é					11	11	11	10	10	10	.	—		.		—
F	f	/		1	7	7	9	9	8	8	8	7	6	7	7	6	6
G	g	///		3	15	5	9	9	7	7	7	9	7	9	9	7	7
H	h	///		3	21	7	7	7	7	7	7	7	7	7	7	7	7
I	i	//		2	6	3	3	3	3	3	3	3	3	3	3	3	3
J	j					7	13	13	10	10	10	11	9	11	11	9	9
K	k					5	9	9	7	7	7	9	7	9	9	7	7
L	l	//		2	14	7	9	9	8	8	8	5	3	5	5	3	3
M	m	/		1	3	3	7	7	5	5	5	7	5	7	7	5	5
N	n	//		2	6	3	5	5	4	4	4	5	4	5	5	4	4
	ñ					9	17	17	13	13	13	—	—	—	—	—	—
O	o	//		2	10	5	11	11	8	8	8	5	5	4	4	4	4
	ö					7	13	13	10	10	10	—	—		—	—	—
P	p	//		2	14	7	11	11	9	9	9	9	9	9	9	9	9
Q	q					7	13	13	10	10	10	9	8	9	9	8	8
R	r	///		3	15	5	7	7	6	6	6	7	7	6	6	6	6
S	s	///		3	15	5	5	5	5	5	5	5	5	5	5	5	5
T	t	//		2	2	1	3	3	2	2	2	3	2	3	3	2	2
U	u	//		2	10	5	7	7	6	6	6	7	6	7	7	6	6
	ü					7	11	11	9	9	9	—		—	—	—	—
V	v					7	9	9	8	8	8	9	8	9	9	8	8
W	w					5	9	9	7	7	7	9	7	9	9	7	7
X	x					7	11	11	9	9	9	9	8	9	9	8	8
Y	y					7	13	13	10	10	10	9	9	8	8	8	8
Z	z					7	11	11	9	9	9	9	9	8	8	8	8
	1					9	17	17	13	13	13	11	9	11	11	9	9
	2					9	15	15	12	12	12	11	10	11	11	10	10
	3					9	13	13	11	11	11	11	10	11	11	10	10
	4					9	11	11	10	10	10	11	10	11	11	10	10
	5					9	9	9	9	9	9	11	8	11	11	8	8
	6					9	11	11	10	10	10	11	11	11	11	11	11
	7					9	13	13	11	11	11	11	9	11	11	9	9
	8					9	15	15	12	12	12	11	10	11	11	10	10
	9					9	17	17	13	13	13	11	9	11	11	9	9
	0					9	19	19	14	14	14	7	5	7	7	5	5

Counting elements.

For every letter or numeral as it occurs in the selected part of the message make a stroke on the line corresponding to the same printed letter (or number) in Form A

The elements composing the letters (or numerals) are, for the Syphon Recorder, as given in Col: A.

Multiply the number of similar letters (or numerals) in Col: l by their respective elements per letter (or numeral) given in Col: A.

Timing message:-

The operator at the Recorder, marks the running tape at 2 points (say) 10 seconds apart. This is to be measured * when convenient to get Lt.

Mark the extreme limits of each of the 6 selected words separately.

Measure the exact length of each word with the same scale *.

Add all 6 measurements to get Lw viz: the length in a continuous line without any spaces between words

Measured lengths of 6 words
40·8 m/m
19·7 ,,
106·5
69·7
77·6
59·2

Lw = 373·5 ,,

*a short length of perforated tape folded in a line with its length provides a suitable scale as only relative measurements are required to give time (T)

‡ Constant (Ew₁) for 5 letter words p.m = 32·18 approx:

Totals = 41 . 179 = Le.
Sum of words = 6

Space elements between all letters but not between words and sentences = s (L − W) = 3 × 35 = 105

Elements in selected words including spaces between letters but not between words Le + s (L − W) = 284 = E.

Length of paper tape between the limits of the above words measured in scale divisions = 373·5 ,, = Lw — ~~see Slips 6 and 16.~~

,, ,, running during t seconds preceding message = } = 217·3 ,, = Lt — ~~See Slips 4 and 12-15~~
,, ,, ,, t ,, after ,, = }

$$,, \quad ,, \quad ,, \quad 60 \quad ,, \quad = 60\,\frac{Lt}{t} \quad ,, \quad = \frac{60 \times 217{\cdot}3}{10} = 1303{\cdot}8\,,, = \text{Lm.}$$

$$\text{Time of receiving the above words in an unbroken line of E Elements} = \frac{Lw}{Lm} = \frac{373{\cdot}5}{1303{\cdot}8} = 0{\cdot}2864 = \text{T minutes} = 17{\cdot}186$$

$$\text{Number of elements received per minute} = \frac{E}{T} = \frac{284}{0{\cdot}2864} = 991{\cdot}5 = \frac{Le + s(L-W)}{T} = e.p.m.$$

[See Speed formula on this Form]

t = 10 seconds. Speed-rate constant = KR × 991·5

SPECIMEN OF SIGNALS AND GENERAL REMARKS.

Trial speed. If the same words be sent the daily trial-speed is very quickly made because the elements in these words (284), when properly spaced, are known so that it is only necessary to measure the time (T) in minutes – see Timing message – and apply it to the very simple formula viz Speed of working = $\frac{284}{T}$ e.p.m. or $\frac{7{\cdot}249}{T}$ standard w.p.m. of 39·18 elements.

The time occupied at the Recorder is the 10 seconds for timing the tape and a few seconds more for cutting off the 6 specimen words. The results can be entered in Form A by anyone when convenient.

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* Books of 24 Printed Forms A, Price 1s. per Book, can be obtained at THE ELECTRICAL REVIEW Office, 4, Ludgate Hill, London, E.C.

the number of elements per minute into *approximately* the equivalent average (English) words (newspaper or code) of 5, 7, or 10 letters respectively. The elements in these so-called *constants* are supposed to represent n times the average elements per letter in a large number of such n letter words—plus a due allowance for space elements between letters and words; but neither these nor any assumed number of elements for the alternative *standard* words are equally applicable to very short and long messages, to newspaper phraseology, to short and long code words, or to foreign languages. This is, however, a difficulty easily surmounted by the simple expedient of stating the speed in w.p.m., *together with the constant employed*, in order to denominate exactly the divisor used to give those w.p.m. If this be done, then the speed so obtained will still have a very definite meaning for the same cable as an index as to its daily efficiency. Moreover, whatever any cable company may for its own convenience think fit to allot to (e); whatever letters (n) to the *word;* or whatever the number of words (w) dealt with, these need not concern anyone else, because he can by means of the *constant* supplied to him correctly convert telegraphic speed expressed in w.p.m. into elements per minute—*e.g.*, either as a basis for calculating the KR, or the weights of conductor and dielectric per unit length, required for any projected cable, in order to give a specified speed of equally legible signals—if worked under the same conditions.

The suggestion is that instead of the speed being *indefinitely* expressed as (w) words, of n letters, per minute, it be given as
(w) ,, (constant) elements, ,, ,, which will be a very definite statement and universally understood.

In the pamphlet already referred to the following *constants* are given :—

	Words.	Letters.	e.p.l. (e)	Constants E w_1	E w_2
For 5-letter words, news paragraphs	1,200	5,670	4·036	32·18	39·18
7 ,, ,,	,,	,,	,,	46·25	53·25
10 ,, ,,	,,	,,	,,	67·36	74·36
For 5-letter words (code words) ...	1,230	6,150	4·377	33·88	40·88
7 ,, ,,	1,256	8,792	4·226	47·58	54·58
10 ,, ,,	883	8,330	4·139	68·39	75·39

$$\left.\begin{array}{l}\text{If for siphon recorder, E}\,w_2\text{ be taken as 40}\\ \text{elements per word of 5 letters, and for Morse}\\ \text{recorder E}\,w_2\text{ be taken as 50 elements per}\\ \text{word of 5 letters,}\end{array}\right\}\begin{array}{c}\text{International}\\ \text{alphabet.}\end{array}$$

the speed in w.p.m. would thereby be standardised and rendered universally comparable.

Elements per Minute.—According to the usual practice, the elements per minute may be supplied by the *sending* station, because the number of elements during any particular minute equals twice the number of centre holes in the perforated paper passing through the automatic transmitter *during that minute;* or, alternatively, the revolutions per minute of the transmitter friction wheel multiplied by twice the number of periphery interstices working against the star wheel (†).

On the other hand, by the writer's method, the *receiving operator* has the advantage of being able to judge the quality of signals at any time; and as often as he likes he can mark the slip running, during 10 seconds, without necessitating the delay of having to make arrangements with the sending station, or troubling the operator to time and measure a very much longer length of perforated tape. Moreover, the *receiving* operator marks the slip running during 10 seconds *while the actual words selected for the speed trial are being recorded.* This is all that the operator at the instrument need do, because the slip passes along to be cut off, measured, and the results entered in Form A by some one else at their leisure.

A.C. Sounders on Fire Alarm Circuits.—Mr. H. A. Bowen, superintendent of fire-alarm system, Cleveland, Ohio, has recently installed a number of Ghegan alternating-current sounders as local signals in fire stations. They are connected directly with the A.C. lighting system, thus doing away with a large number of dry batteries which were formerly required. These A.C. sounders fulfil all requirements, and it is proposed to equip the entire 45 engine houses with them as fast as the installations can be made.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Patent Licences and European Reconstruction.

When the war comes to an end a vast field will be opened in the Allied and Neutral States on the Continent and in Siberia for the supply of power generating plant, and, to a lesser extent, for traction apparatus.

A number of our leading engineering firms will wake up to find their hands tied, and their good prospective markets barred, because they have acted as licensees for patents the continental rights of which have been developed by or assigned to continental interests, and agreements have been signed forbidding export to various countries.

At one time British engineers were pioneers, and were willing to develop and experiment on their own account, but in recent years, especially in connection with steam turbines, fuel oil engines, and power-house plant, they have been prone to putting their heads into nooses, the other ends of the ropes being only too often in the hands of Germans, or of those in neutral countries who are not in a position to resist the German pressure resulting from international finance or questions regarding raw materials for manufacture.

Parliament originally intended patents to last 14 years only, but the taking out of periodical improved patents together with ingeniously worded licence agreements, and the natural tendency of clients to buy plant with well-advertised names attached, have tended to turn a number of patents almost into perpetuities.

On the continent, before the war, despite numerous amusing disclaimers, traction and power-house machinery makers were often closely allied, competition being in general more apparent than real; the influence of the Berlin-Frankfort financial octopus was found in many unexpected quarters, and genuinely independent British firms who attempted to obtain work, even in the neutral outer fringe, found very powerful underground interests opposing them, interests as often as not which had been developed through the peaceful penetration of sympathetic British subjects in London.

In modern days the practical validity of master or other patents depends much more on the financial standing of their owners than on the nature of their subject matter, and sometimes through collusive actions or pure bluff, firms who fear law cases with powerful interests give way, and pay unearned tribute to avoid continuous worry, if not possible ruin, through piled-up law costs or boycotting.

In the past we have suffered severely through international wire-pulling over master patents which our disunited manufacturers have been unwilling to fight; these include three-phase plant, single-phase traction, the fuel-oil engine, the metallic lamp, and various systems of steam turbines. Development has been retarded, and valuable markets practically shut out. One feature of many of those master patents which have been in the hands of so-called "British subjects" has been the fact that, while British firms have not been allowed or encouraged to do business in various continental countries, the continental firms, or their hand-in-glove allies, have been assisted by many in the exploitation of our home and colonial markets.

It would be interesting to know how many "sons or grandsons of Huns" who were disappointed over the non-delivery of German patented goods or machinery will find opportunity after the war of making good the losses of their former confidants with compound interest by further agreements and sympathetic wire-pulling. Many thousands of pounds have been paid in recent years to foreign and other syndicates as licence fees for the almost worthless patents and so-called "experience." The cost of local development or redesigning to suit markets is often overlooked when agreements are made, and it must not be forgotten that to some international syndicates the markets control clauses are worth as much, or even more, than the licence fees, as witness the existence before the war of some companies in England in a state of dividendless bliss, merely to keep undesired independent manufacturers in a state of impotence with regard to certain classes of work in the world's trade.

Those who want to take up a new class of work may find it very nice to buy designs ready made, for a nominal payment or percentage, but contracts for licences should be carefully studied, and unfair, one-sided barring clauses resisted to the utmost, otherwise manufacturers may find they have purchased an almost worthless roll of drawings at the cost of their future in the markets of the world.

Monitor.

A Question of Competition.

It is all too seldom—as I feel sure your numerous contractor readers will agree—that a subject relating especially to electrical contractors is ventilated in your columns; hence my reason for asking your permission to refer to two matters mentioned in your issue of May 31st.

The letter from Messrs. Watson, Marsh & Co. discloses a deplorable state of affairs, and it is to be hoped that, although such cases do undoubtedly exist, they are the exception rather than the rule. As a contractor with branches in several towns where the supply authorities range from a private company with a fully-equipped contracting business to a Corporation with no trading powers, I am happy to say I have not come across a supply authority stooping to such tactics as those quoted by Messrs. Watson, Marsh & Co. in their second case. In fact, I have on several occasions received real help from supply companies, even where they are in open business as contractors. I would suggest in cases such as your correspondents mention that, if these are beyond the scope of the Contractors' Association (which, as a new member of that body, I am sorry to hear) a small committee of local contractors should carefully examine the circumstances of each such case, with a view to legal action wherever possible, for surely the procedure mentioned by Messrs. Watson, Marsh & Co. comes perilously near what the lawyers call "misrepresentation."

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† *Cf.* "Speed Standards and Circuit Efficiency," by Edward Raymond-Barker, in Munro and Jamieson's Pocket-Book, 19th Edit., p. 349.

The other point on which I wish briefly to touch is the Manchester address of the President of the I.E.E. reported in your paper. This is a most interesting general review, but although considerable attention is given to the generating and manufacturing sides, I cannot find the slightest mention of the contractor—or, as he should be called, the electrical installation engineer—though neither generating nor manufacturing would go far without him. Incidentally, this may throw some light on the President's complaint about members "putting away the *Journal* without opening the covers." On many occasions I find that the list of contents *outside* the cover is quite sufficient to justify me—as, I hope, a not narrow-minded contractor—in stopping at the covers. The one bright spot in the I.E.E., from the point of view of the contractor member—the Wiring Rules—becomes the more brilliant from its splendid isolation.

E. Arthur Pinto, A.M.I.E.E.

Ramsgate, *June 3rd*, 1918.

The Electric Propulsion of Ships.

On page 455 of your paper of May 10th, under the heading of "The Electric Propulsion of Ships," you give a summary of a paper read recently by Mr. Eskil Berg describing the electrical installation of the U.S. Battleship *New Mexico*.

Some comparisons are given with other kinds of installations as regards economy. It is necessary, I think, to call attention to a significant error in the presentation of these comparisons. The battleships *Florida* and *Utah* are not, as the writer states, equipped with geared turbines, but with turbines directly connected to the propeller shafts, the speed of which is consequently high. These vessels were equipped with turbines of the Parsons type in 1908, and, whilst they are still doing excellent service, the steam consumptions bear no comparison with the results which can be obtained at the present time, adopting the many improvements that have been made during the last 10 years. The writer states that he gives these comparisons "in order to be able correctly to judge the relative economy of different methods of propulsion"; but to compare the results which it is estimated will be obtained in a new vessel with results that were obtained 10 years ago, whilst ignoring the enormous developments which have taken place during that period, apart from the inaccuracy referred to above, is hardly conducive to such a judgment.

The steam consumption at 19 knots is given as 11.1 lb. per shaft horse-power, whilst the water rate per effective horse is estimated to be 15.0 lb. per hour at this speed. This corresponds to an estimated propeller efficiency of 74 per cent., a very sanguine assumption for a battleship propeller. There is, however, no need to mix assumptions and confuse the issue in this manner. Since with mechanical gearing equally low revolutions can be adopted if desired as with electrical gearing, the propeller efficiency may be taken the same in either case. Whatever turbine efficiency can be obtained with one system can be obtained with the other. There only remain the losses of transmission, the comparison of which is about 10 per cent. in favour of mechanical gearing.

The ingenious manner in which the writer of the paper has converted this obvious inferiority of 10 per cent. into an apparent advantage of between 40 and 50 per cent. is likely to be misleading to your readers, and calls for prompt correction.

Stanley S. Cook.

Wallsend-on-Tyne, *June 4th*, 1918.

A British Ideal for Manufacturers.

"Imperial's" article in your issue of May 31st will be welcomed by many who are seriously concerned about the future of our industry.

The war has shown us that the engineering industry is of the most vital national importance. Is it not possible to have it British? If not, then let us at least know where we are, and with whom we are dealing.

Mr. Wordingham suggested a remedy in his presidential address in these burning words: "Let the first question asked when dealing with a firm be 'Is it British,' and if it be not, then let one be sought that is." They ought to be branded on the memory of every buyer of engineering plant in this Empire of ours. The trouble is to know who is who.

The term "British" as applied to the name of a firm often implied that it was alien. Is it not time that the law was altered to ensure that the word and all that it means to us should not be prostituted in this way; that some distinction in title was made in firms which are wholly British to the core (shareholding, directorate, and policy), so that they may be distinguished at a glance, without reference to Somerset House, from those which are not?

If this were done, and Mr. Wordingham's advice were followed, we should need no tariffs or other protective measures at all.

There is, as "Imperial" suggests, a great scope for a combined effort of all interested in the future welfare of our industry to secure what he terms "a sound basis at home."

Briton.

Government Lighting Restrictions and Saving Coal.

In connection with the new lighting restrictions of the Government (Heating, Lighting, and Power Order), I quote the following from an interesting circular issued by the United States Government Bureau of Standards, Washington:—

"The tungsten lamp has been improved in quality and reduced in price to such an extent that no customer can afford to use carbon lamps, even if he were paid a bonus for so doing. The cost of a lamp is reckoned in cents, but the cost of current to operate it during its life is a matter of dollars!"

As an instance of what this means, the following facts are given:—During the year 1917 approximately 12 million carbon lamps were sold in the United States. If tungsten filament lamps had been used, utilising such sizes as would consume about half the current required by carbon lamps, the following benefits would have been obtained:—

One-third more light would have been secured.

Three-quarters of a million tons of coal would have been saved.

Three million pounds value of electric current would have been saved.

Taking the situation in Great Britain, there were in the year 1917 approximately eight million carbon lamps used, and the savings would have been, on a similar basis, *i.e.*, substituting 30-watt tungsten lamps for 60-watt carbon lamps, as follows:—

One-third more light obtained.

Half a million tons of coal saved.

Two million pounds value of electric current saved.

In view of the above facts, it would seem in the interest of national necessity that all carbon-filament lamps should be replaced by the more efficient tungsten-filament lamps.

F. W. Willcox.

Mazda House, E.C., *June 8th*, 1918.

Billingsgate and Decimal Coinage.

Rarely has our national pride suffered such humiliation as it has over the Billingsgate case, coupled with the reception of the Decimal Coinage Bill by the House of Lords. One would have liked to see the Law Courts receive its case with chilling silence, in a quiet Court which felt that it was dealing with filth, and wanted to get rid of it as quickly as decency permitted. But outside the Court was a mob of yahoos, and inside, a nightmare in a madhouse.

Contrast the interest taken in the Billingsgate case with that given to the Decimal Coinage Bill. Here one would expect interest, public discussion, and eventual acceptance in some form or other. But to debate it there was only a small audience of old gentlemen who wanted to get to their dinner. After a short discussion, one of them got up with words which meant pretty well: "Aw, aw; this is a horrid bore. Let's shunt it." "Agreed," yawned the others. And the Bill was shunted. True, there was the inevitable difference of opinion as to the penny or sovereign basis of the new coinage. This is well worth discussion, but cannot our legislators see that difference of opinion, like that, makes it the more important to get busy at once? A committee should have been appointed right away to inquire into the matter, and the minority should have been willing to accept the verdict of the majority. One must admit, surely, that everyone cannot have his own scheme put into operation.

How many people bear in mind that Japan modernised herself in a generation, and that China is coming along? In a thousand years our mandarins would hardly have got over the period of placid objections had they been in charge of Japan. With them the *present* is never the time to strike. Time is an unending series of *to-morrows*, and they cannot conceive why anyone should be in a hurry to get work done to-day. The wait-a-bit policy is so much easier, and saves so much trouble.

It is time that the engineers bestirred themselves. To anyone who looks on the world with open eyes it is apparent that we are not in a position everlastingly to put this question to one side. We need all our wits and energies for modern languages, history, and mathematics, and we also need systems of coinage and weights and measures intelligible to our foreign customers. This muddling along with our present fuddled conglomeration of antiquities has never served us well. It need not continue to enslave us longer if only we show the requisite energy to throw it over.

Decimal.

June 8th, 1918.

The Two Associations.

With reference to the account of a meeting held at Newcastle, under the auspices of the Local Section of the I.E.E., which appeared in your last issue, it is my duty to correct a mis-statement of fact therein.

Mr. L. L. Robinson mentioned the category of members of engineering staffs in the electricity supply industry from the grade of chief engineer to assistant engineer-in-charge, and is reported to have said :—"That class of engineer had at present no representative body to look after his material, personal, and individual interests."

By this time all the world and his wife know that the E.P.E.A. includes in its membership qualified engineers from chief to junior from both company and municipal stations. While the term "employer" may not loom so large in our ideals as it did in Mr. Robinson's speech, we trust that our humble and sustained efforts to attain our objects as published will result in advantage to all sections of the electrical industry—owners, management, and executive and thence to the well-being of the community, which must be the final "megger."

Many provincial chief engineers and managers have joined the E.P.E.A.; the objection raised by the engineers who have held aloof has been that they could not become identified with an Association registered as a Trade Union. Now that they have performed a *volte face* and decided that, willy-nilly, such a registration is legally essential, one should have thought they would have accepted the existing organisation of the E.P.E.A. as, at any rate, the nucleus of their desires. The only serious difference that can now be found between the E.P.E.A. and the proposed Association is the somewhat higher qualifications for membership required by the E.P.E.A., and on this we fear no further concession could be made.

More credence could be put on the sincerity of their specious requests for unity had the promoters of the B.E.E.A. added the lustre of their names to the roll of the E.P.E.A., and their experience and wisdom to the deliberations of its Council rather than that Mr. Robinson should stump the country like a modern John the Baptist declaring the coming of what in these days of centralisation can be looked upon only as regrettable and inefficient duplication.

George C. Law,
Hon. Publicity Secretary,
Electrical Power Engineers' Association.

London, S.W., *June 9th*, 1918.

The Decimal System.—The report of the Decimal Association for the past year records the introduction of the Decimal Coinage Bill into the House of Lords by Lord Southwark (the discussion on the Bill was adjourned last week, and a Government inquiry into the subject is to be held). Lectures have been given throughout the country by Mr. E. C. Barton and others, with satisfactory results, and resolutions in favour of decimal coinage or the metric system, or both, have been passed by a large number of public bodies, including the British Engineers' Association, the Federation of British Industries, the Municipal Tramways Association, the Tramways and Light Railways Association, the Institution of Electrical Engineers (Manchester and Newcastle), the Institution of Post Office Electrical Engineers at four centres, and numerous Chambers of Commerce, Trade Protection Societies, Teaching Associations, Retail Traders' Associations, &c. The Chartered Institute of Secretaries voted 85 per cent. for decimal coinage and 86 per cent. for the metric system. The Trade Union Congress Parliamentary Committee raised the question of decimal reform in an interview with the President of the Board of Trade in November, 1917.

The International Parliamentary Commercial Conference, held in Rome in 1917, unanimously passed a resolution advocating the compulsory use of the metric system. The British Chambers of Commerce in Italy and Paris last year pressed for the reform, and the movement is making progress in the United States, where the effort to develop trade with South America has revealed the disadvantages of the use of non-metric units. The War Department at Washington, in January, 1918, decided that the metric system should be used in France for all firing data, operation orders, and map construction, and artillery and machine-gun material was to be graduated accordingly. The British Chambers of Commerce in Brazil and the Argentine have urged the necessity of adopting metric measures.

The loss of Sir Richard Burbidge, chairman of the Executive Committee, was very severely felt by the Association. His place has been taken by Mr. T. McKenna, and the new vice-presidents include Viscount Northcliffe and Captain H. Riall Sankey. Mr. W. L. Madgen has been elected on the Executive Committee. The income for the year was £1,940 and the expenditure £715.

British Science Guild.—The twelfth annual meeting of the British Science Guild will be held at the Mansion House on June 19th next, at 4 p.m., the Right Hon. the Lord Mayor presiding. An address on "Education, Science, and Leadership" will be given by the Right Hon. Lord Sydenham, G.C.S.I., &c., and other speakers will be Sir Algernon Firth, Bart., and Sir Henry Newbolt, D.Litt. Cards of invitation may be obtained on application to the Secretary, British Science Guild, 199, Piccadilly, W. 1.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Hollow Flue Damper.

In *Stahl und Eisen*, Frank Tokar describes a hollow flue damper to regulate the draught while in service. The damper is composed principally of two plates A_1 and A_2 (fig. 1). The side A_1 facing the grate is solid, and the side A_2 facing the flue has round its edges the slots B. The bottom edge F is slightly slanting, so that when the damper is lowered it leans on the wall next to the grate. The function of this device is the following :—As soon as the furnace is to be shut down, the damper is dropped to the bottom, and the shutters D are opened. The damper now completely cuts off the grate from the flue, and cold air is drawn in through the space C and the slots B from outside. When regulating the draught, if the escaping gases are very hot, the shutters D are opened accordingly ; the cold air which now circulates through the space C and out at B protects the damper and prevents it becoming over-heated. —*Le Génie Civil.*

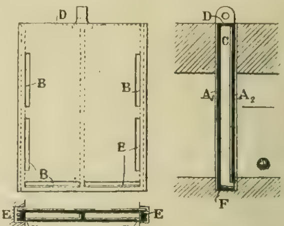


Fig. 1.—Hollow Flue Damper.

Truck Type Switchboards.

We have received from Messrs. Johnson & Phillips, Ltd. Charlton, London, S.E. 7, a booklet (List S 2/1—4, April, 1918), descriptive of their all-steel draw-out truck type switchboards. These boards are constructed in three standard sizes, each cubicle being made in two parts, the stationary portion bolted to the floor containing the bus-bars, fixed contacts, and cable-box, and the truck, or movable portion, fig. 2, containing the oil switch, current and pressure transformers, and the instruments, which are mounted on the front plate. Every cubicle forms a rigid, self-contained, totally enclosed, cellular structure, with no "live" parts exposed when the truck is either in place or withdrawn. The boards are mounted against a wall, and project a minimum distance from it ; there is no need for a passage-way behind them. When the truck is with-

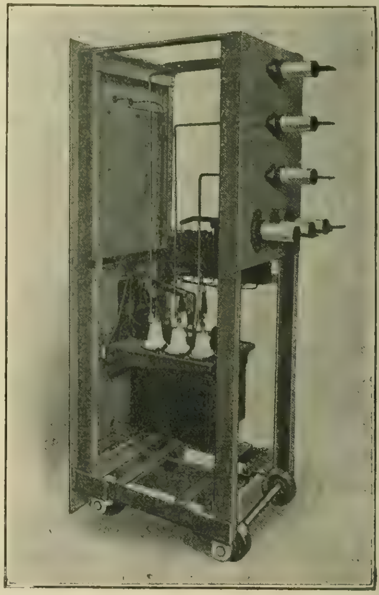


Fig. 2.—Truck Type Switch Panel Rolled Away from Board.

drawn, the apparatus is rendered easily accessible for examination and repair, while a shutter comes into operation which completely screens the live stationary contacts. When re-entering, the truck again unmasks these, and it is then too nearly home to permit of their being touched accidentally. The most important feature in this type of board is the complete system of interlocks which it possesses. It is impossible to withdraw the truck with the switch closed, or to re-insert it with the switch in the closed position. Directly the truck moves, and the fixed and moving contacts begin to separate, it is impossible to operate the switch until such time as the truck is well away from the fixed contacts. This feature also prevents all possibility of the switch being closed before the truck is well home.

The switchboards are capable of easy extension at either end, and individual panels can be readily removed, if desired. The switches are all of the directly operated type, with "free" operating handles. They are of ample capacity and strong mechanical construction. The tanks are provided with air cushioning chambers, and designed with ample volume and head of oil over the contacts. Remote mechanically-operated truck type switchboards can be supplied, if desired, having all the features described for the directly operated truck boards.

Three-phase 6,000-ampere Switchgear.

Advances are continually being made in the size of control apparatus to meet the ever-increasing size of generating units. Fig. 3 shows a remote mechanically-operated switchboard recently made by Messrs. Ferguson, Pailin & Co., Ltd., Edward Street, Higher Openshaw, Manchester, embodying such a switch capable of carrying continuously 6,000 amperes at 650 volts.

It is difficult to combine both adequate breaking and carrying capacity in the one switch and at the same time to retain ease of operation when dealing with very heavy currents; the solution found was to provide two switches in parallel, one to carry the current and the other to break it. Over 90 per cent. of the current is carried by the main switch, which has massive brushes and contacts, but a comparatively small travel. The "snap" switch has lighter contacts, and carries the balance of the current, but has a large travel, as well as being particularly robust mechanically, to break the heavy powers dealt with. This arrangement facilitates the manual operation of the switch, in that the heavy mass has a small movement, and the light mass has a large movement. The "snap" switch is timed by the operating mechanism to make circuit first and break circuit last, so that all arcing takes place on the "snap" switch, and there is no fear of injuring the main contacts. Strictly speaking, no oil is necessary for the "main" switch, but it is provided to assist in cooling it. Furthermore, quick-break plunger arcing contacts are provided in case of accident to the "snap" switch. The main support consists of a 3-in. slate slab with a heavy gun-metal frame, the connections leading out of the switch, as shown in fig. 4; they are of the strip type, and the main brushes making contact directly on to the end of the strips are riveted and sweated to massive contact blocks. The "snap" switch is provided with three separate elliptical tanks capable of withstanding heavy internal pressures without permanent distortion.

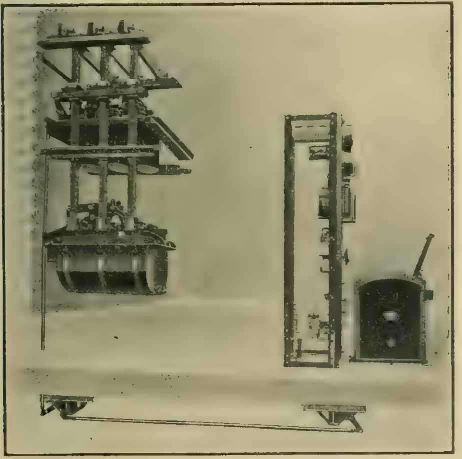


Fig. 3.—Remote Mechanically-Operated Switchboard.

The lever arrangement is of the automatic free-handle railway-signal type, with shunt trip coil. Great assistance is rendered in closing the switch by the use of two long powerful springs attached to the fixed-handle system. In moving the fixed-handle lever forward to engage with the free-handle lever ready for reclosing, the springs are extended and the energy stored is given back on the return movement. This reduces the power necessary to close the switch so much that an average woman can perform the operation with ease, and there is no difficulty with synchronising. The dimensions of the switch may be gauged from the height of the control board, which is 7 ft. 9 in. The complete switch with its lever-box weighs about 1½ tons. The connections and bus-bars are held very rigidly in mica-insulated slate blocks with gun-metal saddles to prevent the bars whipping together or being thrown out of their supports on short circuit.

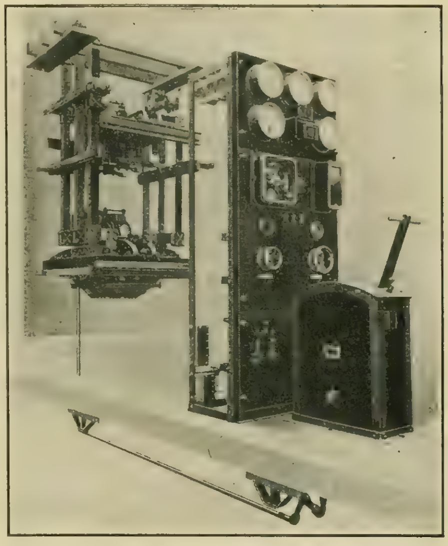


Fig. 4.—Main-Switch Connections.

The Electrical Heating of Water.

In an ordinary electric water heater the water boils in a time depending on the watts consumed, the efficiency, and the initial temperature of the water. There is a loss of heat due to radiation, which reduces the efficiency and increases the time taken to boil any given quantity of water. Mr. L. O. Meyer, of 6, Grosvenor Street, Bedford, has made many experiments to stop this loss, and finally hit upon the idea of using a vacuum between the inner and outer walls of the water-containing vessel, in which is placed an immersion heater; this reduced the loss by radiation to a minimum, and repeated experiments showed that the electrical efficiency was practically 100 per cent. In an actual experiment 390 cb. cm. of water was raised from 16° C. to 100° C. in 7·6 min., and after 12 hours the water had only fallen to 80° C., and boiled up in 1·9 min. The power consumed averaged 298 watts.

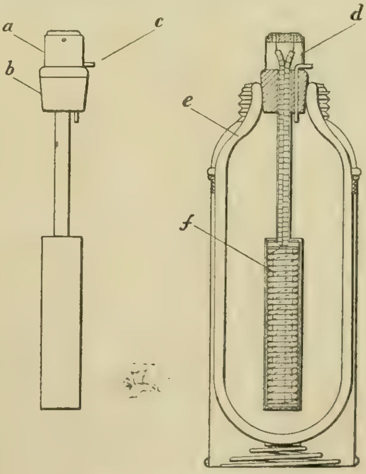


Fig. 5.—Electric Immersion Water Heater.

An immersion heater, which can be used with an ordinary vacuum flask, has been provisionally patented by the inventor, and is shown in fig. 5 herewith; *a* is an ordinary ⅞-in. lamp cap, to which is fitted the cork of the flask *b* and the steam outlet *c*. The heating element is wound on a fireproof tube *f*, and enclosed in a metal casing; the leads are brought up to the lamp cap, as shown at *d*. The space *e* is a vacuum between the walls of the flask. An electric heater involving the same principle is being developed on a much larger scale for use in restaurants, &c., where it is necessary to maintain boiling water at a low cost.

SOUTH WALES AND MONMOUTHSHIRE LINKING-UP.

The interim report of the South Wales and Monmouthshire Joint Committee for the Interconnection of Electric Supply Undertakings, to which we made a brief reference last week, divides the local authorities and companies within the specified area into three groups:—

Group A.—From Neath westward.

Group B.—Cardiff, Penarth, Newport, Pontypool, and South Wales Power Co.

Group C.—South Wales Power Co. and adjacent undertakings, including Rhondda U.D.C., Rhondda Tramways, Pontypridd U.D.C., Merthyr Tramways & Lighting, &c.

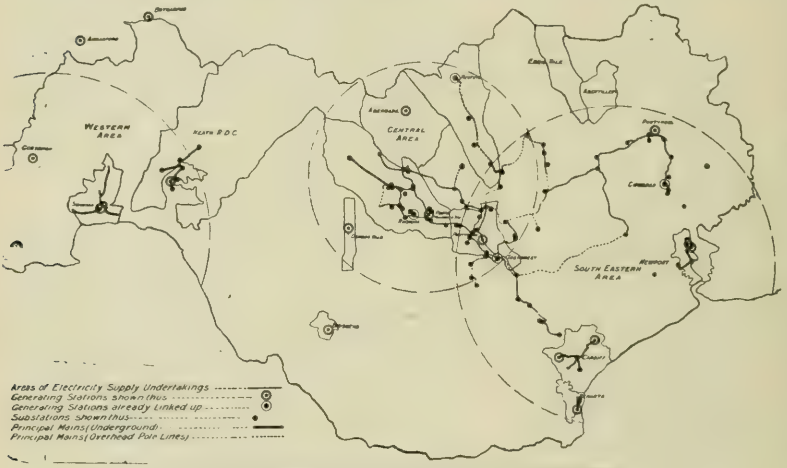
The totals and averages for these areas are as follows:—

Group A.—Units generated per annum, 12,788,045; coal used per annum, 19,163 tons; total coal costs, £17,806; average lb. coal used per unit generated, 3.356; average price per ton, 18s. 7d.

Group B.—Units generated per annum, 61,958,149; coal used per annum, 85,460 tons; total coal costs, £84,492; average lb. coal used per unit generated, 3.08; average price per ton, 19s. 9d.

Group C.[*]—Units generated per annum, 46,880,620; coal used per annum, 55,862 tons; total coal costs, £47,929; average lb. coal used per unit generated, 2.67; average per ton, 17s. 2d.

Brynamman, Carmarthen and Chepstow are undertakings the interconnection of which would not be justified at present. Deducting these undertakings, also Merthyr, Rhondda U.D.C., and Ebbw Vale U.D.C., there remained 17 undertakings to be dealt with in the report. There are private plants in the area, but the Committee decided, after communication with the "Parent" Committee, that they should not be dealt with in this report. The interconnection of Llanelly, Swansea, and Neath offered considerable possibilities, not only as to interchange of load, but further development of the respective supply areas through which the interconnecting mains would pass.


Western Area
Neath R D C
Central Area
South Eastern Area
Newport
Areas of Electricity Supply Undertakings
Generating Stations shown thus
Generating Stations already Linked up
Substations shown thus
Principal Mains (Underground)
Principal Mains (Overhead Pole Lines)

Map of the Area dealt with by the Joint Committee.

It is recommended that the following standards be adopted:—System of supply, 3-phase, 50 periods, 6,600 volts for generators (mostly employed in the stations concerned); 6,600 volts or multiples thereof for transformers, overhead lines, &c.; 6,600 volts or multiples thereof for underground cables.

As the periodicity of Cardiff and Newport is 50, and that of the South Wales Power Co. 25, the proposal to link up could be dealt with either by a sub-station with frequency changers situated at a central position, or the installation of frequency changers in the Cardiff and Newport Corporation power stations. The question of joint working by these three companies was considered, if feasible, as offering certain advantages, and was a proposal admitting of solution either by a combined station under joint control, or the installation of additional plant in any or all of the stations as might be necessitated by local requirements and under joint control; or the installation of additional plant at one or other of the three stations, but without joint control, the other stations taking their supply in bulk from that in which the additional plant would be installed. With regard to Penarth and Pontypool, taking a bulk supply presents no difficulties and is very desirable.

With regard to Group C, the Committee is of opinion that the only feasible way interconnection could be carried out in this group is to make use of the South Wales Power Co.

WAR ITEMS.

German Propaganda.—"We have learned," says the Amsterdam *Handelsblad*, "that preparations are already being made in Germany for the establishment of a Pan-German news organisation over the entire world, and that one of the first steps has been the foundation of a 'National Dutch News Agency' at The Hague."—*Times*.

Under the title "Something Rotten, &c. ——" the *Newspaper World* says:—"It is interesting to note, and the report comes from good authority, that during the last two or three months no fewer than six new weekly or monthly newspapers under German control, and devoted to the promotion of German interests, have appeared in Denmark."

Electricity Staff's War Savings.—Blackburn Electricity Committee has agreed that the sum of £1,200 be advanced to the electrical engineer for the purchase of War Savings Certificates in connection with the weekly subscription for the certificates by the employés in the electricity department.

Tramways and War Bonus.—The Secretary of the Municipal Tramways Association notifies municipal tramway authorities that it is not prepared to advise the municipalities to accede to the application of the National Transport Workers for the 12½ per cent. bonus, and has appointed a sub-committee, with executive powers, to prepare the case and deal with the arbitration.

Exemption Applications.—At Rochdale Tribunal, the Corporation Tramways Committee appealed for H. Smethurst (37, Class A), overhead linesman. Mr. G. Webster, the manager, said he had a telegram in response to representations made to the Tramways Control Committee that the hearing of the case would be suspended whilst consideration was given by the National Service Council. Mr. Webster was asked if representations had been made in the case of another man who was told to join up recently, and he replied that they had. As a result, the man had not yet been taken. The case was adjourned *sine die*.

Worthing Electric Committee has asked the Town Clerk to apply to the Local Tribunal for the exemption of Mr. Porter, the electrical engineer, from military service.

The East Kent Appeal Court has granted exemption until November 30th to Colin Campbell (42, B 1), electrical engineer at the Whitstable electricity works.

At Trowbridge, a month, with fresh medical examination, was granted to E. T. Charmbury, electrician with Messrs. J. and T. Clark.

At Oxford, on June 3rd, two months' temporary exemption was granted to G. A. King (38, Grade 2), electrician at Keble College.

At Folkestone, an appeal was made for R. Clark (41, Class A), electrical engineer with Messrs. Webster & Son, and it was decided that he should not be called up for two months.

On a review, the Hastings Tribunal has granted six months' conditional exemption to F. Wordley (38, Grade 2), electrical engineer, of St. Leonards.

Before the Berks. Appeal Court, the National Service Representative appealed against exemption held by P. G. Lovegrove (35, B 1), electrician. As he has been granted a protection certificate, the exemption was cancelled.

At Windermere, extended exemption was sought by J. K. Thornborough (36, Grade 2), electrical engineer, who is now doing 18 hours per week on work of national importance. Subject to this being continued, he was given temporary exemption until August 23rd.

At Weymouth, the National Service Representative asked for withdrawal of exemption held by J. H. Bolam (42, C 3), borough electrical engineer. It was stated that if the certificate was withdrawn an injustice would be done, as respondent, who holds a protection certificate, could not appeal on occupational grounds.

At Aylesbury, further exemption was sought for A. Hearn (37, C 2), electrical engineer with Messrs. E. T. Mackrill and Son. On the ground that he is engaged upon work of national importance he was granted three months.

Before the Watford Tribunal, a review was made of the case of H. Pollard (39, C 1), collector of electricity charges for the U.D.C. General Fenton said that a year ago it was recommended to the Council that a substitute should be obtained in two months, and he suggested that a good lady clerk could do his work. The exemption was varied to two months, with a view to substitution.

Rochdale Tribunal has granted exemption until August 31st to R. Rhodes (39, C 2), blacksmith's striker, appealed for by the Corporation tramway department, and refused a claim by E. Holden (32, Class A), motorman on the tramways, for whom a substitute has been found.

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[*] In taking the average coal consumption in Group C, the units produced by the destructor plants have been deducted

Exports to China.—The "London Gazette" for June 11th contains some additional names of persons and bodies in China to whom exports may be consigned.

BUSINESS NOTES.

Patents.—The Council of the Chartered Institute of Patent Agents has authorised Fellows of the Institute to make, as from June 30th next, an additional charge of 10 per cent. on the scales of fees recommended by the Council. See "Official Notices" to-day.

Patent Revoked.—An Order, dated June 5th, 1918, revokes Patent No. 104,793, of 1916, granted to J. O. Callender and Callender's Cable and Construction Co., Ltd., for "improvements in multicore electric cables."

Book Notices.—"Tait's Electrical Directory of Australia and New Zealand, 1918." Melbourne: P. G. Tait.—This is the third edition of a very serviceable Directory containing the chief particulars of public lighting, power and traction undertakings in Australia and New Zealand. The name of the authority, system, plant, population, consumers, prices charged, and name of manager, engineer, or other responsible official, are among the information given. It also contains a list of the plants of the collieries of New South Wales, and of the large mines at Broken Hill.

The *Faraday House Journal* for the summer term contains an article on "Three-phase and Ward-Leonard Winding Equipment," which was read before the S.A. Institute of Electrical Engineers, by Mr. A. L. Ballard, B.Sc., and various notes on current topics, &c. Referring to the report of Sir J. J. Thomson's Committee, agreement is expressed with the advantages of the metric system, but in a note it is stated that "the Committee do not definitely recommend the adoption of the metric system"; one of the "principal conclusions" of the report, however, states that "the present chaos of English weights and measures causes waste of time and confusion of thought, and that there are strong educational reasons for the adoption of the metric system." Surely that is a definite enough recommendation for its adoption.

"Workman's Time and Balance Book." London: W. F. Chalker, 64, Copleston Road, S.E. 15. Price 1s. net.—This is a handy book of forms for piece workers and others whose jobs run on for a considerable time, the forms providing for particulars regarding the jobs, time worked, &c. (60 forms), and the money drawn and owing, &c. (30 double forms). We understand that the book has met with a favourable reception amongst mechanical workers.

"*Proceedings* of the American Institute of Electrical Engineers," Vol. XXXVII, No. 5. New York: The Institute. $1.

Industry and Income-Tax.—The Chancellor of the Exchequer received a deputation from the National Union of Manufacturers and the Federation of British Industries on the subject of allowances in income-tax assessments for depreciation of plant and machinery. Mr. Bonar Law agreed to certain concessions, including allowances to be made for the first time for depreciation in the value of buildings, with a right of appeal to the Board of Referees.

Swedish Export Prohibitions.—Glass tubes, being parts of accumulators, and rectangular glass jars (for accumulators), and manufactures of wax, are now prohibited for export from Sweden. —*Times.*

Amalgamation.—Provisional arrangements have been made for the amalgamation of the businesses of Ruston, Proctor and Co. and R. Hornsby & Sons. The new name will be RUSTON AND HORNSBY, LTD.

Liquidations. — R.E.T. CONSTRUCTION CO., LTD.—Creditors should send particulars of their debts, &c., to the liquidator, Mr. A. Page, 28, King Street, by July 25th.

SCORCH ELECTRICAL CO.—The controller, Mr. C. E. Barker, 21, Finsbury Pavement, E.C., has applied for his release.

Bankruptcy Proceedings.—BIRKETT, W. D., factor of electrical goods, Whitley Bay.—June 27th is the last day for receipt of proofs of dividend by Mr. C. Woollett, the Official Receiver, 21, Mosley Street, Newcastle-on-Tyne.

Trade Announcement.—MESSRS. PYNE HUGHMAN AND CO., LTD., announce that their London office (High Holborn) will be discontinued as from June 22nd, after which date their business in the United Kingdom will be conducted by Messrs. Gladstone, Wyllie & Co., who have been appointed their agents for that purpose, and to whom all communications, after 21st inst., should be addressed at 36, Lime Street, London, E.C. 3. (Cables: "Wyllie, London." Inland telegrams: "Wyllie, Grace, London." Telephone: "Avenue 89.")

Plant for Disposal.—Sheffield Corporation tramways and motors department invites offers for 12 G.E. 52 traction motors. Burnley Corporation electricity department has for disposal a quantity of surplus electrical plant, including one Belliss compound engine, 12 shunt-wound motors, and six dozen arc lamps. For particulars, see our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Australia.—The year's working of the Sydney City Council's electric light undertaking, after providing for interest and sinking fund on the capital expenditure, together with depreciation charges, shows a loss of £19,870, which is attributed to the increased cost of materials, coal, &c., and the loss of revenue caused by the strike in August last. The capital invested in the undertaking at December 31st last was approximately £3,000,000.—*Sydney Daily Telegraph.*

Mobilong (South Australia) District Council, says *Tenders*, has resolved to apply for a loan of £3,500 for the installation of an electric light and power plant for Murray Bridge electricity to be supplied by the River Murray Milling Co. The scheme includes a comprehensive arrangement of street lighting for practically the whole of the town, including lighting the railway station, goods yard, and wharf.

The Borough of Ararat (Vic.) has applied for an Order in Council authorising the Council to supply electricity for public and private purposes within the shire of Ararat.

The Liverpool Plains Shire Council is considering the question of acquiring the electric lighting system installed at Gunnedale, N.S.W., by Pike Bros. The existing agreement expires in October, when the Council has the option to purchase.

The Junee Municipal Council, N.S.W., is taking steps to raise a loan locally with which to finance an electric lighting scheme.

Batley. — LAND PURCHASE.—A contract has been approved by the Corporation for the purchase of land at Healey for an electric sub-station.

In the case of electricity consumers serving with the Forces, the minimum charge for energy of 25s. per annum for the year ended March 31st, 1918, is not to be enforced.

Burnley.—RATE REVISION.—The Electricity Committee has decided that a rental of 12½ per cent. per annum on the actual cost of motors and starters be charged on all hired in future. The Sub-Committee has been instructed to consider the scale of charges for electricity at present in force.

Canada.—NIAGARA POWER POOLED FOR WAR PURPOSES. —A Canadian Order in Council provides virtually for a pooling of Niagara power on the Canadian side of the border. Sir Henry Drayton, the Dominion Power Controller, has made arrangements with the Toronto Electric Light Co., the London Electric Co., Ltd. (Ont.), and other companies, whereby those corporations will resume operation of steam power plants. The power will be at the disposal of the authorities until the needs of munitions and other essential industries are met. It is reported that Sir Henry Drayton received assurances in Washington that sufficient coal would be made available without reduction of the allotment of coal to Canada. Officials in charge of the control of power and fuel have indicated that in all probability further restrictions will have to be placed on the use of light, power, and coal by non-essential industries, merchants, storekeepers, and private consumers.—*Electrical World.*

Carshalton. — PRICE INCREASE. — The South Metropolitan E.L. Co. has notified the U.D.C. that the maximum price for energy (6d. per unit) has been increased by 10 per cent. The minimum consumption charge has been waived.

Colchester.—LOAN APPLICATION.—The T.C. has applied for a loan of £5,950 for a new generating set, by which it is hoped to save £700 a year in coal.

Continental.—NORWAY.—A syndicate has been formed at Skien to utilise a number of small falls aggregating about 200,000 H.P. It is proposed to manufacture nitrate, aluminium, or carbide, according to market demands.

The "Norsk Hydro" annual report for the year ending June, 1917, shows a profit of 6½ million dollars against 5 millions for the previous year. The companies' capital is 15½ million dollars, and a total horse-power of 300,000 is operated for the production of nitrates and carbides. The waste heat from these electrochemical processes is now utilised in low-pressure steam turbines.—*U.S. Com. Reports.*

SPAIN.—BARCELONA.—Shortage of coal and poor quality coal have had an adverse effect upon the quality of gas, and on several occasions Barcelona streets have been almost in darkness on this account. For this reason electric public lighting has been substituted through a great part of the city, and some 10,000 lamps of 50 and 100 C.P. have been installed. To complete the public lighting, the Compania Barcelonesa de Electricidad has asked the civic authorities for permission to run special underground mains in the principal streets and a special overhead network in the outlying districts.

Dublin.—RESTRICTING DEMAND.—It is stated that the Electricity Supply Committee, as a result of coal shortage, intends to enforce a charge of 2s. per unit for electricity used in excess of two-thirds of the 1917 quantity, the arrangement to be adopted from the quarter beginning towards the end of September. Special consideration will be given to users of electric power for essential industries. Street lighting in the Dublin area has been considerably curtailed, one-third of the arc lamps and about half the number of the smaller lamps having been put out of commission, while the electric incandescent lamps in use have been reduced from 100 to 50 C.P.

Elland.—Loan Sanction.—At the last meeting of the U.D.C. it was reported that the Director of Electric Supply had granted support to the Council's application for sanction to borrow £2,000 for electricity extensions.

Eton.—Revaluation.—The Assessment Committee of the B. of G. has decided to revalue the undertaking of the Uxbridge and District Electric Supply Co., Ltd., on the ground that the present profits are 200 per cent. up since the last assessment.

Lewes.—Street Lighting.—The T.C. has renewed the agreement with the Electric Light Co. for public lighting for a year.

Limavady (Co. Derry).—E.L. Scheme.—On account of the closing down of the local gasworks, the urban authorities have under consideration an electric lighting scheme for the town, which it is hoped will be in operation early next winter. There is plenty of water power available, and there is already a good private electric installation in the town.

Lincoln.—Electricity Supply Scheme.—Subject to the Finance Committee being satisfied that the necessary financial arrangements can be made, the Council in Committee has decided in favour of a scheme recommended by Sir John Snell for an electricity supply for the city, providing for the acquisition of Messrs. Clayton & Shuttleworth's power station, and its immediate extension; and that contracts be entered into with Messrs. Clayton and Shuttleworth, Ltd., and Messrs. Ruston, Proctor & Co, Ltd., for the supply of electric power. The City Council having adopted the scheme, the Ministry of Munitions is to be approached with a view to financial assistance being given, it being stated that the scheme would probably involve the expenditure of a quarter of a million pounds.

London.—Price Increase.—The City of London E.L. Co. has given notice that the war percentage to be added to charges will be at the uniform rate of 50 per cent. for electricity for all purposes. The increased charge will apply to the September quarter.

Maidstone.—Sale of Plant.—The T.C. has disposed of a condenser at the electricity works which on March 31st stood on the books at £384, for £475.

Morley.—Year's Working.—Notwithstanding an increased revenue amounting to £504, there was a deficit of £1.184 on the electricity undertaking for the past year, after allowing for interest and sinking fund, as compared with £1.054 for the previous year.

New Ross (Co. Wexford).—E.L. Scheme.—The Gas Co. has applied for liberty to extend its objects to the production of electricity for lighting and power.

Newcastle-under-Lyme.—The T.C. has approved the recommendation of the Electricity Committee to accept the offer of the Stoke-on-Trent Corporation to lay the whole of the mains, under the proposed linking-up scheme, between the central power station at Hanley and the Newcastle electricity works, subject to the Newcastle Corporation paying for that portion of the mains laid in the borough of Newcastle at a price to be agreed upon, and also subject to the approval of the L.G.B.

Nottingham.—War Bonus.—The employés of the electricity department, supported by the National General Workers' Union and the Tramway and Vehicle Workers' Association, are asking that the 12½ per cent. award shall be granted to them in addition to the recent advance of £1 over pre-war rates. Notices have been sent to the Committee on Production, and, if nothing is done in the matter within 21 days, action is threatened.

Arrangements have been completed by the Corporation for the purchase, at a cost of £19,000, of a large area of land, with a frontage to the river Trent, the site being one which may be used for a new generating station.

Power Co.'s Bill.—The Shropshire, Worcester, and Staffordshire Electric Power Bill has passed the House of Lords; it was stated that a clause had been inserted in the Bill, which would enable District Councils to purchase the undertaking proposed to be established in such a way as would lead to no public loss.

Ramsgate.—Price Increase.—The Electric Supply Co., Ltd., has applied to the T.C. for permission to increase the price of energy, and the Council has decided that particulars of increased charges made for electricity on account of the war shall be obtained from other towns in Kent.

Salford.—Year's Working.—At the Town Council, Councillor M'Dougall, deputy chairman of the Electricity Committee, stated that the income of the undertaking last year amounted to £156,955, as against £173,999 the previous year, and the gross profit was £66,698 (£70,924), and net profit £13,309 (£21,253). Wages had increased fully 50 per cent. The Committee estimated its profits to be £8.500, but the Finance Committee had asked it to hand over £10,000 to the relief of the rates. They would have to ration their supply, and this would certainly affect their revenue.

Shipley.—Price Increase.—The District Council, last week, decided that as from July 1st the charge for electricity for lighting shall be 6d. per unit, an advance of 1d. The past year's working shows a net loss of £605.

Slough.—Bulk Supply.—The Slough and Datchet Electric Supply Co., Ltd., has applied to the B. of T. for an order permitting it to supply energy in bulk to the Windsor Electrical Installation Co.. Ltd.

Stourbridge.—Price Increase.—The Midland Electric Corporation for Power Distribution, Ltd., has again increased the price of energy by 10 per cent., a total advance on pre-war prices of 50 per cent.

Sunderland.—Failure of Supply.—According to the *Sunderland Echo*, a complete failure of the electricity supply occurred on June 4th for nearly three hours, by which the local works and shipyards were seriously inconvenienced, and the tramway service had to be discontinued. Apparently the trouble was due to a breakdown in the boiler house of the Corporation electricity works. For some time past the department has been working under extreme difficulties owing to war conditions, which have been enhanced by the fact that a 7,500-kw. turbine which was to have been delivered last August is not yet in commission. The Electricity and Lighting Committee has under consideration tenders for the installation of additional boiler plant, which is to be proceeded with as soon as the sanction of the Ministry of Munitions is received.

Tasmania.—King River Scheme.—The Government Hydro-Electric Department is making a survey of the King River gorge on the Mount Lyell Co.'s Railway, with regard to the suitability of that part of the river for the installation of a second power scheme. The proposal is to construct another dam in addition to the main King River scheme power dam, and to use the water from the main dam after it has passed through the turbines at the chief power station higher up the river. The banks of the river at the gorge are very steep, and the cut in the mountains through which the river passes is very narrow, so that the position is highly favourable for the development of an economical scheme. It is estimated that 15,000 h.p. can be developed at King River gorge; this, taken in conjunction with the original power scheme of 45,000 h.p. on the river, will yield 60,000 h.p. If the scheme materialises, which is deemed highly probable, the power generated will be sufficient to supply all mining and smelting works on the West Coast of Tasmania, in addition to leaving a surplus for manufacturing enterprises.—*Melbourne Age.*

In reply to an application from the Port Cygnet and Kingsborough Municipal Councils for electric light and power from the State Hydro-Electric Department, Mr. J. H. Butters, general manager, stated that no more power could be supplied at present, owing to the difficulty of getting materials and machinery. At present he thought it would probably be 15 to 18 months before power could be supplied.

The carbide of calcium producing plant established in Tasmania by the Hydro-Electric Co. is practically completed, and is about to be put in operation. An expert in carbide manufacture has been secured from Switzerland to supervise the plant.

Torquay.—Year's Work.—The financial statement of the Corporation electric light undertaking shows total income for the year ending December 31st of £19.639. After deducting working expenses, a working balance of £4,476, plus £245 value of stores, has been placed to the net revenue account. After allowing for interest £1,682, £2,899 for sinking fund charges, £637 war service allowances, and £866 for new services, the deficit on the year's working totalled £1,372. Total amount borrowed in connection with the undertaking £75,900, indebtedness at the end of the year £44,741.

Wigan.—Reduced Expenditure.—Ald. Grimshaw, referring to the report of the electricity works manager, said the coal consumption had been reduced by 7.196 tons. The average price per unit during the past year was a little lower than in the previous year, and had it compared with that year their profits would have been £750 more. They had paid £2,216 to the suspense account. The loss for the year ending March, 1916, was over £6,000; for the year ending March, 1917, it was £7,712, but the past year showed a profit of £1,091. On the items where he had direct control the manager had reduced the expenditure by £7.950.

Wolverhampton.—The Electricity Committee has recommended that the application of the Brotherton Tubes and Conduit Co., Ltd., for the supply of electricity for power purposes be acceded to, and that the necessary transformer and switchgear, &c., be provided at an estimated cost of £500.

Worcester.—Year's Working.—The report of the city electrical engineer, Mr. C. M. Shaw, on the work of the department for the year ending March 31st, 1918, shows that the total income was £31,393, an increase of £6,215: the gross profit was £15,307, and after providing for interest, sinking fund, and income-tax there remained a net profit of £3,136, a record figure, in spite of extra costs of £7,000 over pre-war prices of coal and labour. The gross capital expenditure on the undertaking amounts to £205,495, of which £126,807 has been written off, leaving a net debt of only £78,688. Practically the whole of the generating plant has been modernised, and the capacity of the plant is in excess of the demand, so that the undertaking is in a very favourable position. From the Powick water-power plant over a million units have been obtained, a record output. The total output was 4,637,269 units sold, comparing well with 3½ millions in the previous year. Motors and radiators aggregate 5.535 h.p. Over 4 million units were sold for power and heating, compared with less than 3 millions in the previous year, and the revenue from these sources was £19,704, whilst lighting only brought in £8,112. The works costs were 0·77d. per unit sold, compared with 0·86d. per unit in the previous year, a remarkable result in view of the difficulties of the times, and largely due to increased output, efficient stokers, and economical turbine plant. The engineer points out the importance of providing cheap power to attract manufacturers to the city, which is not favourably situated for inclusion in a bulk supply system, and, therefore, should continue to develop its own undertaking. During the past five years, under Mr. Shaw's management, the output has been approximately doubled, and the net profit has been continuously raised from £463 in 1914 to £3,451 in 1918. During the same period the loan capital expended has increased by only £22,515, and £34,550 has been paid off. Years ago the undertaking was by no means prosperous, but by changing over from single-phase to two-phase supply, gradually modernising the plant, and developing the power load, Mr. Shaw has succeeded in placing it on a sound financial basis.

Worthing.—Year's Working and Price Increase.—There was a deficiency on the electricity undertaking for the year ended March 31st last of £844. An estimated deficiency of £333 is expected in respect of the year ended March 31st, 1919, and to meet this it is proposed to make the following alterations:—All units sold for lighting by ordinary meters: fixed rate plus 50 per cent. instead of fixed rate plus 30 per cent.; all units sold by slot meters: on collection a further charge of 1½d. in every shilling; an additional charge of 6d. per quarter for meter rent.

TRAMWAY AND RAILWAY NOTES.

Bolton.—Rail Purchase.—The Tramways Committee has received the sanction of the Tramways (B. of T.) Committee for the purchase of 100 tons of tram rails from Bolchow, Vaughan and Co., Ltd., Middlesbrough.

Electric Vehicle.—The Electricity Committee has approved the purchase of an electric vehicle from Electric Mobile (Leeds), Ltd., for the use of the department.

Year's Working.—The annual report of the Corporation Tramways Department for the year ended March 31st, 1918, shows total revenue £177,386, working expenses £102,531, gross profit £74,854, interest and repayment of loans £35,803, depreciation fund £17,105, war service allowances £1,968, leaving a credit balance of £19,978, which, with the balance of £24 brought forward from last year, amounts to £20,002, from which £15,500 has been transferred to the rates account, leaving £4,502 to be carried forward. The depreciation fund at March 31st stood at £79,146, total capital expenditure to date £574,757, loans repaid £261,861, average working expenses per car-mile, including power cost, 9·140d.; average total revenue per car-mile, 15·81d.; passengers carried, 39,581,828, an increase of 5,103,896; car-mileage, 2,692,052, an increase of 13,095 miles.

Darlington.—Fares Revision.—The Electric Lighting and Light Railways Committee has decided to suspend halfpenny fares on the tramways for the duration of the war.

Halifax.—Reduced Service.—The Tramways Committtee's recommendation of reduced service of cars and alterations of stopping places was approved by the T.C. last week. It was stated that there had recently been a big reduction in the coal stocked at the electricity works, and now there was only about a week's supply in stock. If the shortage of coal became acute, the tramways would suffer first, and would have to stop. The Tramways Committee estimated that the proposed reduced service in the mornings and evenings and early on Sunday afternoons would result in a reduction of 2,305 car-miles per week.

Leicester.—Year's Working.—The accounts for the year ended March 31st show that the municipal tramways had a revenue of £243,000 and a net balance of £9,320. Revenue per car-mile averaged 15·289d.

Liverpool.—Fares Revision.—The Council, last week, approved the proposed increase of fares on the tramways.

Manchester.—Year's Working.—During the year ended March 31st last the Corporation tramways carried 240,914,369 passengers on a car-mileage of 18,540,585 miles, an increase of 21,762,385 passengers and 152,283 miles run on the previous year. Financially the total revenue amounted to £1,119,861; after deducting working expenses, £630,219, and war service allowances, &c., £156,936—total £789,155—the gross profit was £332,706, which, with interest added, amounts to £348,078. From this amount, interest, sinking fund, rent and tax charges are deducted, leaving a balance of £184,058, of which £100,000 was contributed to rates, £10,830 for income-tax, and the balance to reserve fund. The earnings per car-mile were the highest, so far, on record—viz., 14·496d., an increase of 1·723d. over 1916-17, while working expenses only increased by ·344d. per car-mile. The tramways department purchased some 30,200,000 units from the electricity department at 1·183d. per unit, and used 1·628 units per car mile; the motor-'buses ran 216,818 miles and carried 1,682,822 passengers; the 'buses cost 9·466d. per mile, including depreciation, to run, and earned 13·424d. per mile approximately.

Oldham.—Tramway Purchase.—In connection with the proposed purchase of the Oldham, Ashton, and Hyde Electric Tramways, the B. of T. has approved the action of the local authorities along the route in requiring the tramway company to sell so much of the undertaking as is within the areas of such authorities.

Rotherham.—Track Renewal.—The Tramways Committee proposes to relay about 5 miles of track, at a cost of about £55,000, as soon as labour and material are available.

Swansea.—Refuse Vehicle.—As a result of a visit to Birmingham, Sheffield, Nottingham, and other places, a deputation of the Swansea Health Committee has recommended the purchase of two electric refuse lorries, at a cost of £1,200 each, for use at Swansea, and the Committee has approved of the recommendation.

Sheffield.—Car Purchase.—The Tramways Committee is to purchase second-hand tramcars from the London County Council at an approximate cost of £7,500.

Tramway Statutory Maximum Fares.—The Select Committee appointed to consider the temporary modification of statutory requirements with regard to the charges for the conveyance of traffic on tramways, has issued its report. Evidence tendered by the Tramways and Light Railways Association and the Municipal Tramways Association shows that all tramway and light railway undertakings are injuriously affected by increased working expenses due to the war, wages having risen from 60 to 100 per cent., and the advance in cost of materials varying from about 100 per cent. to over 200 per cent. on pre-war rates. In addition, the increased cost of fuel, and, consequently, of power, coupled with restrictions imposed on supply, should be taken into consideration. The larger revenue earned by many tramways does not compensate for the constantly advancing working costs; but in most of the large towns, where the tramway systems are generally owned by the municipalities, there is still a margin, since the fares charged are in most cases lower than the statutory maximum. Some possibility of relief should be afforded to those undertakings which cannot increase their revenue to compensate them for the abnormal working expenses occasioned by war conditions. Although in the case of municipalities deficits can be made good out of the rates, the passenger should not be carried at a loss.

The Committee therefore recommends that the Board of Trade should be empowered by general legislation to permit the temporary modification of statutory requirements with regard to the charges for the conveyance of traffic on tramways and railways constructed wholly, or mainly, on public roads, in the case of undertakings whose financial circumstances are proved to the satisfaction of the Board to have been injuriously affected by causes arising out of the war, the word "temporary" covering a period limited to the duration of the war and two years after its termination.

Walthamstow.—Ex-Soldier Tramcar Drivers.—It is stated that after training a large number of discharged soldiers to drive tramway cars, the manager of the tramways has come to the conclusion that when the Army discharges a man as unfit he is physically incapable of standing the strain and exposure of a motorman's life.

York.—Year's Working.—Receipts of the tramways last year (ended March 31st last), were £40,272, compared with £36,191 for the previous year. Per car-mile the receipts were 11·23d., as against 10·47d.

CONTRACTS OPEN AND CLOSED.

OPEN.

Lancaster. — July 16th. Electricity Committee. 6, 9, and 12 months' supply of slack or nuts (screened and washed). Mr. J. B. Patterson, Electricity Works, Marton Street.

London.—L.C.C. The Highways Committee recommends that tenders be invited for the supply of cotton-covered copper wire for the tramways department.

Spain.—Oviedo.—Transformers, motors, and accessories, makers, representatives, or importers who are in a position to supply this material within a short time, and principally static transformers of 50,000 volts and large capacity, should write to Don Narciso H. Vaquero (Saltos de Agua de Somiedo), Apartado 53, Oviedo.—*La Energia Electrica.*

Spenborough.—June 19th. The U.D.C. invites tenders for the supply of 4,000 tons of slack coal for the electricity works.

Warrington. — June 18th. Electricity and Tramways Committee. High-tension lead-covered cable and medium-tension rubber-covered cable. See "Official Notices" May 31st.

CLOSED.

Colchester.—T.C. Pump for the electricity works. Mumford & Co., £171.

Gillingham (Kent).—T.C. 640-B.H.P. Willans Diesel engine, coupled to a G.E.C. alternator with 615-K.V.A. transformer, by the British Electric Transformer Co., and apparatus for burning tar oil. Banks, Warner & Co., Ltd., £12,038.

Glasgow.—The Tramways Committee recommends the following offers for acceptance :—

Armature coils.—British Westinghouse Co., Ltd.
Trolley wire.—F. Smith & Co., Ltd.
500 tons of rails.—Bolckow, Vaughan & Co.
200 tons of rails.—Walter Scott, Ltd.

Maidstone.—T.C. 740 yd. of H.T. cable. General-Pirelli, Ltd., £603.

Other tenders were :—

Callender's Cable Co., £820; B. I. & Helsby Cables, Ltd., £814; W. T. Henley's Telegraph Works Co., £790.

Sheffield.—City Council :—

W. T. Glover & Co., Ltd.—Two feeder cables between the Blackburn Meadows power house of the Sheffield Corporation and the Rotherham Corporation power house; also for cables at revised schedule of prices.
A. Reyrolle & Co., Ltd.—E.H.T. feeder panel at Neepsend power house.
Davidson & Co., Ltd.—Centrifugal fan, casing, and other apparatus for ventilation of boiler house basement.

Wolverhampton.—Corporation Electricity Committee. Accepted tenders :—

Reyrolle & Co., Ltd.—Additional switchgear, £824.
Mather & Platt, Ltd.—Two pumps for cooling towers, £1,044.
Willans & Robinson, Ltd.—Changing extractor system of the rest of the 5,000-KW. turbo sets from series to shunt, and supplying the third system on the shunt system, £430.
Globe Tank & Hurdle Co., Ltd.—Air shaft for boiler house, £62.
Ferguson, Pailin & Co., Ltd.—Three sets of carbon dioxide gas recording apparatus, £50 each; two reactances, £1,577.
Alley & MacLellan, Ltd.—Two each 18-in. and 16-in. valves, £148.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, June 14th. At 7.30 p.m. Paper on "Electric Accumulators," by Mr. R. Rankin.

Electrical Power Engineers' Association (London Division).—Monday, June 17th. At 7 p.m. At St. Bride's Institute, Fleet Street, E.C. Address by Mr. A. C. Bostel on "Trade Unions and Incorporated Societies."

Midland Section.—Saturday, June 15th. At 3 p.m. General meeting.

Northern Division.—Tuesday, June 18th. At the Grosvenor Hotel, Deansgate, Manchester. At 7.30 p.m. Special general meeting.

Incorporated Municipal Electrical Association.—Thursday, June 20th. At 10 a.m. Annual general meeting at the Town Hall, Manchester. Presidential address by Mr. J. S. Watson, Borough Electrical Engineer, Bury, and Discussion on "The Failure of Electric Power Supply," introduced by Mr. S. L. Pearce. At 3 p.m. Visits to Stuart Street Power Station, and the works of the British Westinghouse Co., Ltd. At 8 p.m. Smoking concert at the Engrinees' Club.

Friday, June 21st. At 9.30 a.m. Council meeting. Resumed discussion on "Electric Power Supply." Annual general meeting.

NOTES.

Engineers and the "Secret Character Note."—Irritation against what working engineers call the "secret character note," and which employers simply denominate an "inquiry note," appears to be coming to a head in the Midlands. According to the *Birmingham Post*, a rule covering the Birmingham and District Engineering Employers' Association and the National Employers' Federation makes it incumbent upon a member of either body, before engaging a man or woman, to issue an inquiry note, and on the late employer to reply. This note contains no fewer than 10 questions relating to dates of beginning and ending the last employment, the reason for leaving, character, grade of labour, rate of wages and bonus, &c. The existence and use made of this inquiry note have long been resented by the men, and, encouraged, perhaps, by the withdrawal last year of the leaving certificate, steps are now being taken by the men's Union to attempt to get it abolished. The Birmingham and Midland Allied Engineering Trades' Societies' Federation states that it regards its use as an injustice and "an infringement of the rights of freedom of contract." It is, therefore, agitating for a conference with the employers, at which it will present reasons for a cessation of the practice. The men admit that the cases of "victimisation" are few; still, they hold the custom (which dates back to pre-war days) to be objectionable, and they are evidently determined to attempt to put an end to it.—*The Machinery Market.*

Electric Furnaces.—At a meeting of the Sheffield Section of the Junior Institution of Engineers, on April 26th, Mr. Verdon Cutts read a paper on "Electric Furnaces." He described several types of small melting furnaces, but more particularly directed his remarks to electric furnaces designed for the treatment of metals, pointing out that the easy control of temperature in these furnaces gave them a great advantage over the gas or coke-fired furnaces for such work.

The same advantage was secured in the case of melting furnaces in foundries, since the risks of burning metal during delays in pouring, or through other reasons, were greatly reduced in the case of the electric furnace. The inability of the large foundries to supply steel castings on the scale demanded during the war compelled many engineering firms to consider the question of putting in their own electric furnaces. The lecturer cautioned all such to ensure that the furnace load of current was always available, as the plant could not be worked economically and effectively unless worked regularly and quickly. This was not possible where the necessary load was not constantly available, and the running of this type of furnace by night only must result in a considerable loss due to the units absorbed in preheating. He particularly dwelt on the extravagance of running a plant understaffed or with inefficient lifting tackle, and instanced a case in which he traced a loss of 38 units per ton to unsuitable lifting gear.

Ferro-alloys were generally secured from the Continent prior to the war, but necessity had compelled us to produce our own, with the result that our manufacturers had shown considerable enterprise in the rapidity with which high-grade ferro-alloys had been produced.

Training Disabled Men.—There are now more than 40 men learning trades in the classes which have been established at the Huddersfield Technical College, for discharged soldiers, under the scheme of the Ministry of Pensions. Many discharged men attend for various studies as ordinary students, but the two special classes for discharged soldiers only are in electrical engineering and boot-making. The courses are for 12 months, and the fees are paid by the Ministry of Pensions.

Thanks to the initiative of Sir Arthur Pearson, acting in conjunction with Mr. Hugo Hirst and the B.E.A.M.A., a scheme introduced by Dr. Wheeler in the United States has been adopted in this country for the employment of blind soldiers in taping armature coils, work which they can do with ease and efficiency.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Orders for the week ending June 23rd, 1918, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. E. G. Fleming.

Next for Duty.—Capt. W. Hynam.

Saturday, June 15th.—Commandant's Parade at Headquarters, 2.15, for drill in Hyde Park. Dress: Service dress, drill order; haversacks and water bottles, with rifles and side arms. Every member should endeavour to attend this Parade.

Monday, June 17th, to Saturday, June 22nd.—Drills as usual.

Sunday, June 23rd.—Commandant's Parade at Waterloo Station, 8.45 a.m., for work at Esher. Dress: Service dress, drill order, haversacks, and water bottles, with rifles and side arms. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Effect of the War on Lamp-Bulb Composition.—As a result of the war, a decided change in the making of glass bulbs for incandescent lamps has come about during the past year. This change, according to F. A. Poor, of the Hygrade Lamp Co., Salem, Mass., will eventually result in the lowering of the cost of finished lamps. The importation of potash was stopped on account of the war, and to-day only a very small percentage of this material is used in lead-glass bulbs. Lime-glass bulbs have come into use as a substitute, the lime-glass bulb being made by automatic machinery instead of being blown by hand. The glass is also melted in large tanks, so that it is sometimes called tank glass, and this tends to reduce the cost of manufacture, since lead-glass bulbs are melted only in pots of small size.

Another advantage of lime-glass is its softness and quicker speed of melting as compared with lead-glass. In time this is likely to lead to faster production, and the light green colour is pleasing. The shrinkage has gradually been brought down from a maximum of 50 per cent. to 15 to 30 per cent., depending upon the extent to which a factory substitutes lime glass for lead-glass. The Hygrade Co. has found progressive improvement in shipments of lime-glass. The practice of receiving lime-glass bulbs from the glass factories all cracked off will soon become standard, and this, with experience in handling the newer material, is likely to lead to decreased shrinkage and lower production cost throughout the usual range of commercial sizes.

The Rivetless Ship a Possibility.—Electric welding as a substitute for riveting is being tested by the U.S.A. Government at four shipbuilding yards, and so far the work is proving highly satisfactory. According to recent data, the process will increase the strength of the joint at least 25 per cent. and decrease the time of building a hull nearly 50 per cent. Eminent marine engineers claim that there will be a saving in labour of 60 to 70 per cent. The machine employed is the Wilson welder. At present the plates are being lap-welded, the plates being overlapped at least 2 in. (5 cm.), sometimes more, and each edge welded down. In the future it is the intention to butt-weld the plates, in which case they will be bevelled so that when placed edge to edge V-shaped grooves will be formed, into which the welding metal will flow, leaving a welt over the top of the V. The reverse side, the one exposed to the sea, will be left perfectly smooth. By this method considerable steel will be saved which otherwise is wasted by overlapping, and, at the same time, the weight of the ship will be reduced. Plates 3½ in. (9 cm.) in thickness have been welded, this being the maximum thickness used on the particular jobs where observations are being made. The advisability of casting entire steel sections and then welding them together is also under consideration. Repair work can be done without removing the broken parts from a ship. No preheating or annealing is necessary. A novice can be developed into a satisfactory electric welding operator in 30 days, and from available data it is estimated that 30 welders can do the work of 125 riveters. The Wilson welding outfit operates on what is known as the arc principle, and consists of a motor-generator set, the generator of which is wound for 35 volts. The welding metal serves as one electrode, while the ship plates constitute the other electrode.—*Marine Review*, May, 1918.

Institution and Lecture Notes.—Junior Institution of Engineers.—On Monday, June 24th, Sir Wilfrid Stokes, K.B.E., will deliver the third Gustave Canet Lecture at the Lecture Hall of the Institution of Civil Engineers, Great George Street, at 6 p.m., taking for his subject "The Stokes Gun." Tickets for the lecture may be obtained (free of charge) from the Secretary of the Institution at 39, Victoria Street, S.W. 1.

Society of Engineers (Inc.).—The *Journal* for April contains a paper on "The Power By-Product Problem," by T. R. Wollaston, in which current ideas on thermal efficiency and the relative advantages of coal and gas firing for boilers are challenged, and the installation of producer recovery gas plant at large generating stations is advocated. The balance-sheet shows an excess of expenditure over income of £85, and the accumulated fund account shows an excess of assets over liabilities of £668.

On Monday last a special lecture was delivered before the Society on "War on and Under the Sea," by Mr. Edwin Hall, and there was a large attendance of members and friends.

Manchester Steam Users' Association.—The annual report of the Committee of Management for the year 1917 shows that 11,571 boilers were under inspection, and the revenue was £24,533. The accounts show an expenditure of £22,342 and a gross surplus of £2,191; after allowing for a war-time bonus to the staff of £1,124, and sundry special expenses, there remains a net balance of £913. The number of boilers inspected showed an increase of 348, and the income was the highest on record. No explosion occurred from any boiler under inspection and guarantee.

Association of Consulting Engineers (Inc.)—The report of the Committee for the year ending April 30th, 1918, states that war conditions have greatly influenced the work of the members, who have been burdened with negotiations with the Government Control Departments. The Committee took action with respect to private consulting work undertaken by an important Government official, and to an attack on consulting engineers by the engineer to a company, with satisfactory results. The Committee deprecates the tendency of Government Departments to include consulting engineers on their staffs or on Committees, instead of employing them as consultants in the usual manner, and urges that the work of reconstruction which will follow the war ought to be planned out in advance, so that it can be put in hand at once when peace returns. A case in which consulting engineers, acting for a water company in an arbitration, successfully maintained their right to be paid 10 guineas a day, is recorded. Two members have given their lives in their country's service, and 11 are serving with the Forces. The accounts for the year show an excess of expenditure over income of £40, leaving a net balance of £116.

At the annual general meeting, on May 27th, the chairman (Mr. Frank Gill) emphasised the leeway that was taking place in public works and the importance of making due preparation to meet the situation at the end of the war. The report and accounts were unanimously adopted, and new members of the Committee were elected :—Messrs. H. Lapworth, A. H. Preece, H. J. Rope, A. P. Trotter, F. J. Moffett, and J. A. Warren. Votes of thanks to the hon. solicitor and auditors, to the hon. secretary (Mr. A. H. Dykes), and the hon. treasurer (Mr. Lowcock) were awarded.

Overcoming the Difficulties of Long-Span Construction.—It is to the great transmission networks of the Pacific Coast that engineers continually look for important suggestions in power transmission. The Coast has continually been in the front line of progress, and the Pacific plants have had to deal with topographical conditions which have made their pole lines of very diversified and interesting character, especially since long spans have been used far more freely than in most other parts of the country.

For protection against the strains produced by changes of temperature, at least one very interesting development has been made. The strain insulator group is attached at the tower side, not directly, but to a cable passing over pulleys, and thence to heavy concrete weights inside the tower, so that the connection is a flexible one ready to yield to the necessary degree when extra strains are imposed on the cable, and so to keep the tensions uniform. Considerable progress has been made, too, by dividing the strain of long spans between groups of insulators installed in parallel, with equalising yokes when of the disk type. An article in the *Electrical World*, May 4th, contains suggestions of value to those interested in the subject.

The Association of British Electrical Engineers.—In our report of the meeting at Newcastle, last week, Mr. L. L. Robinson was erroneously designated "hon. secretary of the Supply Section." This office is occupied by Mr. A. P. MacAlister, Mr. Robinson being chairman of the Provisional Committee.

Economy in Lighting and Heating.—The main object of the Fuel Order is simply to *save coal*; it is necessary to reduce the consumption of coal by at least one quarter. But the householder may choose for himself the manner of saving it, by equating his coal, gas, and electricity on a common basis and then dividing his consumption between them at pleasure. The first step is to ascertain the maximum amount of coal—the common denominator —that one will be allowed to take per annum; deducting from this amount, in tons, the actual minimum consumption of coal with which one can rub along, the remainder multipled by 800 gives the number of units of electrical energy that may be consumed for heating and cooking; or, if the household is still unregenerate, multiplying by 15,000 gives the number of cubic feet of gas that may be used for these purposes. A separate allowance of electricity will be provided for lighting purposes, or, if desired, an allowance of gas. Owing to the importance of the products of coal when carbonised in gas works, it is not desired to restrict the consumption of gas if it can be used instead of raw coal for heating and cooking. In some areas where sufficient gas is not available, it will be necessary to reduce the coal equivalent to 12,000 ft. per ton —elsewhere, it may be possible to make it 18,000 cb. ft. Local authorities will set up Fuel and Lighting Committees to handle the rationing system, with the assistance of Local Fuel Overseers. One year's allowance of coal may be stocked, and those who can lay in their stock in the summer time are urged to do so.

We have been informed of the reasons which have rendered it imperatively necessary to curtail the consumption of coal; these reasons, we can assure our readers, are unimpeachable and compelling, and as a national duty it behoves every one of us to comply with the terms of the Order not only in the letter but also in the spirit, by exercising the utmost economy.

Recommendations issued by the Illuminating Engineering Society, with the concurrence of the Board of Trade, advise consumers to ascertain their past consumption from the local gas and electric supply undertakings, and to examine their gas and electricity meter readings. Gas fires or electric radiators should be used only when strictly necessary, and cooking should be so arranged as to use ranges for a minimum length of time, and to their full capacity whilst in use. The use of hot water should be reduced to a minimum. To avoid waste of light, inefficient types of lamps or burners should be avoided, and only the number of lamps, and the candle power necessary for the purpose, should be used. The lamps or burners should be so placed and equipped as to give the maximum illuminating effect.

Carbon filament lamps should be discarded, and in large rooms gas-filled ("half-watt") electric lamps should be used. Old and blackened electric lamps should be replaced by new ones which will give the same light for a smaller consumption

To get the best results from any lamp it should be equipped with a well-designed shade, globe, or reflector, screening the light from the eyes and directing it where it is chiefly needed. If cleanliness is neglected lamps of unnecessarily high consumption have to be used to produce a given illuminating effect. There should be sufficient light in kitchens and pantries, rooms where much reading and writing is done, and on stairways; economy may fitly be exercised in drawing rooms and dining rooms, sufficient illumination being provided from local shaded lamps on tables where meals are laid, or reading and writing is done, and the rest of the room lighted in a subdued manner. Small lights may be used in passages and halls or on landings, and should preferably only be turned on when such passages, &c., are actually in use.

"Only turn on those lamps and burners which are strictly necessary, and turn them off immediately they are no longer required."

Appointments Vacant.—Charge engineer (£200), substation superintendent (£250), engineer clerk of works to superintend plant installation for the Sunderland Corporation electricity department; two switchboard attendants (60s. + 12½ per cent.) for the Blackburn electricity department; chief engineer (£400 + 12½ per cent.) to superintend the maintenance of the engine and electrical plant at King's College Hospital; switchboard attendant (63s.) for the Battersea B.C. electricity works; junior switchboard attendant (29s. 6d. + 9s.) for the Rhondda U.D.C. electricity department; power station and depôt superintendent (£200) for combined tramway and lighting undertaking in South Wales. See our advertisement pages to-day.

The Use of Petrol.—At Lancaster Castle, last week, W. G. Birkett and Polly Birkett, of Keswick, who were summoned for wrongful use of petrol, were stated to have used a motor-cycle and side-car in Morecambe, and, when questioned by the police, produced two business cards, one bearing the name "Birkett and Hewitson, motor engineers, Keswick," and the other "The British Electric Co., Whitley Bay." In defence, Mr. Birkett said he was on business, having arranged to see the Morecambe electrical engineer, who thought of purchasing a motor-generator. He was also going to the Alhambra Theatre to see a suction plant which he understood was for sale. The defendants were fined 40s. and 20s., respectively.

Cable Temperatures.—According to the *Electrical World*, laboratory tests have definitely determined that the maximum safe working internal temperature of an 11,000-volt cable is 150° F. (65·6° C.) A peculiar phenomenon is manifested beyond that temperature. By reason of the high voltage a hysteresis effect occurs in the insulation that generates heat. Up to 150° F. this loss increases directly with the temperature, but after 150° F. is reached the curve takes a very sharp upward turn and quickly reaches the failure point. Safe operation depends, therefore, upon the ability to keep the internal cable temperature below 150° F.

The Value of Higher Steam Pressures.—In an article by Mr. J. T. Foster, in the *Electrical World* of May 11th, a statement is made of the yearly saving which can be realised from the use of higher steam pressures, with the capitalised value of this saving for various loads, coal rates and rates of capitalisation. The author states that it is probable that within the next five years operating pressures will be increased to 500 lb. or 600 lb. (227 kg. to 272 kg.), so it is interesting to calculate just what would be the probable effect on the fuel cost under those conditions. Curves are shown of the theoretical Rankine-cycle water rates and thermal efficiencies, which may be used to ascertain the money value of any change to higher pressures. The method of calculating the points is illustrated by tables, and the use of the chart for obtaining the information is illustrated by a problem worked out in detail.

Terrestrial Magnetism.—The report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, states that the mean values of the magnetic elements for 1917 and three previous years are as follows : –

	Dec. W.				Dip.	
	Deg.	Min.	Hor. force.	Vert. force.	Deg.	Min.
1914 ...	15	6·3	0·18518	0·43317	66	51·2
1915 ...	14	56·5	0·18508	0·43315	—	51·8
1916 ...	—	46·9	0·18494	0·43313	—	52·7
1917 ...	—	37·0	0·18477	0·43305	—	53·6

Electricity in Domestic Service.—At a Conference of the Association of Teachers of Domestic Subjects, held at the University of Birmingham, recently, Mrs. Carey Gilson in her presidential address urged that in these days scientific housekeeping was strongly to be recommended. Housewives must be taught how to save labour. Electricity was woman's salvation. The time had come when it should be used for washing clothes, cooking food, and cleaning and heating the houses.

Author Fined.—At the Old Bailey, last week, Henry Murray, author, was fined £100 for publishing a defamatory libel concerning Sir W. F. Marwood, Joint Permanent Secretary of the Board of Trade, whom he attacked because of his attitude toward the Gattie railway goods clearing-house scheme.

Large Gas Engines in a Colliery Power Station.—A 6,000-KW. gas-electric station utilising gas from 120 new coke ovens has been installed at the Zollverein pit (Caternberg). The amount and quality of gas available—viz., 5,700 cu. m. per hour, with calorific value 4,000 calories—yields 6,000 KW., using gas engine sets consuming 3,800 calories per KW.-hour, whereas only 3,600 KW. could be obtained by using the gas to heat boilers serving steam turbine plant. Three double-acting four-stroke twin tandem engines are installed for the 3,000-KW. sets. Cylinder diameter, 1,150 mm. ; stroke, 1,300 mm. ; maximum continuous output, 4,500 H.P. at 94 R.P.M.—*Colliery Guardian.*

Electrical Power Engineers' Association.—Since the inauguration of the West Yorkshire Section at Leeds, on March 27th, the Committee elected at that general meeting has met on seven occasions. Seven Sub-Committees have been at work respectively on the draft rules of the Association ; Whitley Report ; propaganda work and publicity ; salaries ; membership ; social arrangements and papers ; and keeping a watch on the formation of other Associations with similar or allied objects, in order to consider negotiations with them and avoid any dissipation of strength by the formation of a number of Associations.

These Sub-Committees have already done considerable work ; as an example, the Rules Sub-Committee has held nine meetings and formulated draft rules, which also set forth the objects of the Association. These have been approved by the General Committee, and are now under discussion by the National Executive Council.

The total membership of the Association is over 1,000, and this Section alone has now a membership of 104 ; all engineers engaged in the production, transmission, distribution, or utilisation of electrical power are invited to make application to the Association at once. The address of the Secretary of the West Yorkshire Section is Mr. P. Furness, 6, Ash Grove, Earlsheaton, Dewsbury.

The British Engineers' Association.—In order to meet successfully the period after this war, which will always be known as an engineers' war, engineers of all descriptions must organise and co-operate ; professional engineers are already well organised in various technical and scientific societies, but this is not sufficient —there must also be co-ordination and co-operation between the specialised branches of the engineering industry. Further, there must be co-operation between the manufacturing and technical engineers and such men as the educationalists, the chemists, the metallurgists, the accountants, the finance experts and the transport experts, and any others who are intimately connected with the engineering industry in some form or other.

The British Engineers' Association is taking steps to bring about this necessary co-ordination and co-operation through its—

"A" members, consisting of manufacturing firms ;
"B" members, consisting of bodies closely allied with the industry ; and
"C" members, consisting of individuals actually engineers, and of those intimately associated with the industry.

The first three members of the "C" section are Sir Maurice FitzMaurice, C.M.G., ex-President of the Institution of Civil Engineers ; Mr. Michael Longridge, President of the Institution of Mechanical Engineers ; and Mr. C. H. Wordingham, President of the Institution of Electrical Engineers.

The object of the new section is to bring together individual engineers of all descriptions, so that the best brains, wherever they may be found, may be utilised in the discussion and the solution of the numerous problems affecting the industry, and so that, together with the "A" and "B" sections, legislative and other results can be obtained, which otherwise would be impossible. It is intended that the section shall be a live and integral part of the Association, with adequate representation on the Council of the Association ; that in the large engineering centres branches of the section shall be formed and worked by local committees elected by the members themselves ; and that the section shall in no wise take the place of the existing Engineering Institutions, Associations and Societies, but act as a connecting link between them.

By this means it is hoped that many individual engineers will be brought into closer touch with the manufacturing engineers ; the universities, the technological colleges, and the works will be brought into much more intimate contact ; manufacturing engineers will be able to benefit by assistance and suggestions from individual engineers at home and abroad ; the men best qualified to advise upon, and to carry out, any research work undertaken by the Association will be found ; the individual engineer being kept informed of the many problems engaging the attention of research authorities will be able to assist in their work by his own observations and suggestions ; assistance will be given to individual engineers in carrying out research work, developing inventions, and in making investigations known to manufacturers ; the services of individual engineers will be used to the best advantage in educational and research work, and on the numerous problems confronting the industry, such as standardisation, economical production, works arrangements, costing systems, wear and tear, &c. ; assistance will be given to individual engineers in securing appointments ; facilities will be provided for obtaining information from home and oversea sources not ordinarily accessible ; efforts will be made to improve the status and interests of individual engineers, and to influence legislation affecting them and the industry ; assistance to individual engineers will be given through the Association's offices at home, and its connections and introductions abroad will be at the disposal of members ; and that all information of interest and value will be circulated to the "C" members.

British nationality (by birth) is a *sine qua non*, and no member may hold foreign interests of a nature antagonistic to the objects of the Association, which is essentially British in fact as well as in name, and will serve British interests exclusively.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Capt. SINCLAIR, son of the chairman of the Swansea Corporation Electric Lighting Committee, who was a charge engineer at the station there before the war, and has had a distinguished career with the Forces, has so far recovered from his breakdown in France as to be able to do light work. He had been mentioned in dispatches, and was ultimately gazetted out of the Army on May 24th with the honorary rank of captain. The Committee instructed the engineer to place Capt. Sinclair on light outdoor duties for the present.

The Glasgow Tramways Committee has approved of the recommendation that Mr. LACHLAN MACKINNON, traffic manager, be appointed deputy general manager of the department.

It is proposed to increase the salary of Mr. T. B. NUTTER, chief assistant at the Burnley electricity department, from £190 to £250 per annum.

Mr. EDWIN SEDDON, chief assistant electrical engineer, Edinburgh Corporation, was presented with a tea and coffee service by the electricity works staff on the occasion of his marriage on June 10th to Miss W. M. Lough, of Forest Gate, London.

Bury Electricity Committee has recommended to the Salaries Committee that the salary of the electrical engineer shall be increased from £650 to £750 per annum.

Bolton Town Council has advanced the salary of Mr. J. BARNARD, the general manager of the tramways department, from £525 to £700 per year. Replying to discussion, Coun. Horrocks said it was a sound commercial proposition that a well-tried and efficient servant should be recognised. The tramways manager was responsible for a capital account of over half a million ; the receipts were £177,000 a year ; the financial state of the department, the equipment, and running conditions, would bear comparison with any undertaking in the country, and all this was very largely the result of the energy and ability of the manager.

The electrical engineer to the Batley Town Council, Mr. S. D. JONES, has been granted an increase of £25 per annum.

At Bradford E.C., the Deputy-Chairman reported that, unfortunately, owing to a considerable period of over-strain the health of the city electrical engineer had broken down, and that his medical adviser had prescribed a period of some weeks' rest. The Town Clerk was requested to convey to Mr. ROLES an expression of the Committee's sympathy, and of their desire that after due treatment and freedom from duty he (Mr. Roles) may make a speedy and complete recovery.

The Bridlington T.C. has advanced the salary of Mr. F. FFRENCH, deputy electrical engineer, from £165 to £185 a year.

Mr. W. J. SOWTER, electrical engineer, Bray, Co. Wicklow, has been appointed hon. district engineer under the Coal Controller.

There were 27 applications for the position of manager of the Edinburgh tramways. Communications were received from two managers in England who stated that they would only be prepared to be considered applicants if the salary was not less than £1,250 per annum instead of £1,000, the sum mentioned in the advertisement.

The salary of the electrical engineer and tramway manager at Kirkcaldy has been increased by the Corporation from £400 to £450.

Mr. HANTON, station superintendent of Hawick, has been appointed station superintendent at Rawtenstall.

General.—The Albert Medal of the Royal Society of Arts for 1918 has been awarded to Sir R. T. Glazebrook, F.R.S.

At Trinity Wesleyan Church, Roundhay, Leeds, on June 6th, Mr. Christopher Pratt, second son of Mr. Thomas Pratt, President of the National Chamber of Trade, and head of Christopher Pratt & Sons, Ltd., electrical contractors, Bradford, was married to Miss Mary Petch, of Leeds. The bridegroom is head of an important department of his father's firm, and in that connection was presented to the King and Queen during their recent industrial tour in the West Riding. The employés of Messrs. Christopher Pratt & Sons, Ltd., sent a gift of a set of fish knives and forks.

The Edison Medal Committee of the American Institute of Electrical Engineers has awarded to Colonel J. J. Carty the Edison medal, in recognition of Colonel Carty's work in the science and art of telephone engineering.

Roll of Honour.—Private T. W. Shepherd, Lincolnshire Regiment, who is a prisoner of war, was employed at the Leeds Corporation electricity works.

Corporal T. Wolstenholme, Lancashire Fusiliers, Private A. Roberts, East Lancashires, and Corporal L. Christian, Lancashire Fusiliers, who are all prisoners of war in Germany, were employés of the Chloride Electrical Storage Co., Ltd., Clifton Junction.

Private T. Preston, of the A.S.C. (Motor Transport), who has died of wounds, was employed by Messrs. Matthews and Yates, Ltd., Swinton, Manchester.

Lieutenant K. W. Allman, R.A.F., who was killed in an accident at Lincoln whilst flying last week, was employed in the drawing office of the Peel-Conner Telephone Works, Ltd., Salford.

Private W. Spence, Durham Light Infantry, was killed in action on May 23rd. He was in the electrical fitting department of Messrs. Pease & Partners, Ltd., Esh Colliery, County Durham.

Private H. Burke, Lincolnshire Regiment, reported missing from March 21st, was employed by Messrs. Wright and Wood, electrical engineers, Halifax.

Private T. Houghton, formerly in the employ of Messrs. Dick, Kerr & Co., Ltd., is a prisoner of war in Germany.

Driver N. E. Gripper, killed whilst serving with the Society of Friends' Ambulance Unit of the British Red Cross Society with the French Army, was in civil life on the staff at the Blackburn Corporation electricity works.

Sergeant R. M. Binns, Cheshire Regiment, who is a prisoner of war, wounded, was engaged at Glossop with the Urban Electric Supply Co., Ltd. He has been recommended for the Military Medal for bravery.

Private O. G. Billingham, Manchester Regiment, formerly on the staff of the Northampton Electric Light Co., reported missing on March 23rd, is a prisoner of war in Germany.

Lance-Corporal J. Astbury, Royal Fusiliers, formerly with Messrs. Taylor, Tunnicliffe & Co., Hanley, has been killed in action.

Sergeant C. R. Morgan, R.E., who was formerly in the postal telegraph department at Barnstaple, has been awarded the D.C.M. for devotion to duty whilst in charge of testing and putting through telegraph and telephone battle lines in France.

The Military Medal for gallantry in repairing damaged telegraph lines under heavy shelling and bombing, has been awarded to Private J. Capper, who enlisted from the electrical works of the L. & N.-W. Rly. Co., at Crewe.

Captain Harold Gooch, R.E., awarded the Military Cross, was before the war lecturer in electrical engineering and physics in the Belfast Technical Institute.

Major R. G. Dunlop, R.E., formerly on the staff of Messrs. Siemens at Glasgow, has been wounded. He had previously been awarded the Military Cross.

Private T. Young, Durham Light Infantry, who has been awarded the Victoria Cross, was on the outbreak of war employed as a motorman at the Towneley Drift, High Spen, Durham.

Pioneer W. Cooper, R.E., is in hospital at Lindi, East Africa, with malaria. He was employed by Mr. W. Andrews, electrical engineer, Bradford.

Private H. Evans, Lancashire Fusiliers, killed in action on May 28th, was employed by Messrs. I. Frankenburg & Sons, Ltd., Salford.

Private J. Lloyd, Coldstream Guards, killed in action, was formerly an electrician with Messrs. Cammell, Laird, Ltd., Birkenhead.

Private W. H. Green, Somerset Light Infantry, missing since April 15th, is a prisoner of war in Germany, and wounded. He was employed by the St. Helens Cable and Rubber Co., Ltd., Warrington.

Major Brazell, R.E., who before the war was a junior charge engineer at the Swansea electricity station, has been awarded the Military Cross for services in the field. He had previously been awarded the Croix de Guerre.

Rifleman W. J. Bridge, son of Mr. Albert Bridge, of the Electrical Review, reported missing three months ago, is now officially reported a prisoner of war in hospital at Hammerstein, West Prussia.

Birthday Honours.—Like the sands of the seashore or as the stars in the firmament in number are the recipients of Birthday Honours in recognition of war work. We tender our congratulations to Mr. Horace Darwin, F.R.S., chairman of the Cambridge Scientific Instrument Co., Ltd., and a member of the Munitions Inventions Department Panel; to Mr. J. E. Thornycroft, and to Mr. A. M. Smith, chairman of the Management Committee of the Engineering Employers' Federation, upon becoming Knight Commanders of the Order of the British Empire.

The following have been made Commanders of the Order:—Mr. E. J. P. Benn, Mr. G. J. Churchward (chief mechanical engineer, G.W. Rly.), Mr. A. J. Hill (chief mechanical engineer, G.E. Rly.), Mr. E. M. Iliffe (Controller, Machine Tool Department, Ministry of Munitions), Mr. H. Mensforth (general works manager, British Westinghouse Co.), Mr. G. H. Nash (chief engineer, Western Electric Co.), Mr. J. Newlands, C.I.E. (Controller of the Central Telegraph Office, G.P.O.), Mr. W. W. Bradfield (managing director of the Marconi Co.), Mr. E. S. Shrapnell Smith (chairman of the Standing Joint Committee of the Mechanical Road Transport Association), Mr. A. W. Tait (chairman, British Aluminium Co., Ltd.), Mr. W. L. Topple (Superintendent of the Electric & Ordnance Accessories Co., Ltd.), Mr. C. H. Wordingham (Director of Electrical Engineering to the Admiralty, and President of the I.E.E.).

The list of new Officers of the Order is a very long one. Amongst others known to our readers there appear Mr. G. H. Baillie (Chief Technical Adviser on Dilution of Labour, Ministry of Munitions), Mr. H. G. Barwell (superintendent of the Eastern Telegraph Co., Ltd., at Malta); Mr. W. B. Burnie, D.Sc. (Brighton Technical Institute), Lieut.-Com. V. R. d'Almeida Campos, R.N.R. (manager of the cable ship *Colonia*), Mr. T. Fender (works superintendent of Messrs. Vickers, Ltd., Barrow,), Mr. A. P. M. Fleming (of the British Westinghouse Co.), Mr. F. P. Fletcher (Electrical Engineering Department of the Director of Electrical Engineering, Admiralty), Mr. H. A. Madge (wireless telegraphy expert, H.M.S. *Vernon*), Mr. H. B. Reynolds (Messrs. Babcock and Wilcox, Ltd.), Mr. S. Robinson (Messrs. Vickers, Ltd.); Sec.-Lieut. P. A. Sanders (Messrs. Davey, Paxman & Co.), Mr. E. H. Shaughnessy (staff engineer, G.P.O.), Mr. H. J. S. Stobart (Messrs. Chance Bros. & Co., Ltd.).

The honour of Knighthood has been conferred on Major Archibald Gilbey Gold, who has been connected with the electrical industry for many years. Sir Archibald Gold, who is a Deputy-Lieutenant and a Justice of the Peace for Essex, is a Major in the Essex Yeomanry, and took a leading part at the outbreak of war in raising a reserve regiment of this force. He joined Messrs. G. E. B. Pritchett and T. W. Pritchett when the partnership of Pritchetts & Gold was formed in 1892, and has been a director of Pritchetts & Gold, Ltd., since the conversion of that firm to a limited company in 1900. It will be remembered that Pritchetts & Gold, Ltd., amalgamated with the Electrical Power Storage Co., Ltd., in 1915, and Sir Archibald Gold remains a director of the present company. We congratulate him upon the honour, so well-merited, that His Majesty has been pleased to confer upon him.

Members of the Institution of Electrical Engineers will be pleased to learn that Mr. G. E. Franey, official shorthand writer to the Institution for many years, has received the O.B.E. in recognition of his work as personal secretary to the Secretary of State for India during his tour in India from October, 1917, to May, 1918.

NEW COMPANIES REGISTERED.

British Engineering Co. (London), Ltd. (150,638).—Private company. Registered June 5th. Capital, £8,000 in 1,900 10 per cent. ord. shares of £1 each, and 2,000 def. shares of 1s. each. Iron, brass, and metal founders, mechanical, mining, gas, aero, sanitary, civil, and water engineers, aeroplane and part manufacturers, motor engine and body builders, ship and boat builders, &c. The subscribers (each with one share) are:—R. Gill, 66, Victoria Street, S.W., consulting engineer; G. Watson, M.I.C.E., M.I.Mech.E., Walter House, Bedford Street, W.C. 2. The first directors are: R. Gill and S. B. Saunders. Solicitor: E. L. Gill, 11, Queen Victoria Street, E.C. 4.

East Somerset Agricultural Power Co., Ltd. (150,640).—Registered June 5th. Capital, £5,000 in £25 shares. Threshers, ploughers, sawyers, and general agricultural workers by means of steam, electrical, or other power, hauliers, owners and hirers of traction engines and tractors, &c. Minimum cash subscription, £2,000. The first directors are:—S. B Bartlett, Middle Farm, Yarlington, Som.; W. Burrough, Welham Farm, Shepton Montague, Som.; F. C. Golledge, Hadspen Farm, Pitcombe, Som.; A. Hunt, Brickyard Farm, Maperton, Som.; M. R. Morrish, Manor Farm, North Cadbury, Som.; J. Pither, Old Bank House, Castle Cary, Som. Solicitors: Woodforde and Drewett, Castle Cary, Som.

Pratt Bros., Ltd., Edinburgh (10,072).—Private company. Registered in Edinburgh, May 31st. Capital, £5,000 in £1 shares. To take over the business of an electrical contractor, mechanical and general engineer, manufacturer and agent carried on by A. Pratt as Pratt Bros. The subscribers (each with one share) are: R. [illegible], 16, [illegible] Street, Edinburgh, engineer; A. Pratt, West Park Place, Edinburgh, electrical contractor; D. Pratt, West Park Place, Edinburgh, electrical engineer; M. Pratt, West Park Place, Edinburgh, engineer. The first directors are: R. [illegible], A. Pratt, D. Pratt, and M. Pratt. Registered office: [illegible] West Park Place, Edinburgh.

Edinburgh Electrical Engineering Co., Ltd. ([illegible]).—Registered May 24th. Capital, £2,000 in £1 shares. To carry on the business of electricians, electrical, gas, or mechanical engineers, suppliers of electricity for the purposes of light, heat, motive power, or otherwise. The subscribers (each with one share) are:—J. Plunknett, 119, George Street, Edinburgh, electrical engineer; J. A. Morton, 55, Morningside Road, Edinburgh, electrical engineer; G. Lyall, 47, Frederick Street, Edinburgh, electrical engineer; J. Beck, 101, Hanover Street, Edinburgh, electrical engineer; T. Hogg, 21, Nicholson Street, Edinburgh, electrical engineer; D. [illegible] Munro, 11, Randolph Place, Edinburgh, electrical engineer; J. Dodds, 64, Thistle Street, Edinburgh. The first directors are not stated. Solicitor: Walter Finlay.

Telephone Third Hand, Ltd. (150,680). — Private company. Registered June 7th. Capital, £100 in £1 shares. Owners of patents, &c. The subscribers (each with one share) are: Elsie I. Norman, 337, Edgware Road, W. 2, secretary, Mrs. L. Kewley, 274, Elgin Avenue, Maida Vale, W. The first director is A. E. Ford (director of Northern Motor Co., Ltd., and of Ford Boat Co., Ltd.) Registered office: 42, North Audley Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lithanode, Ltd.—Satisfaction in full on February 17th, 1917, (*a*) of debentures dated June 21st, 1901, securing £500, (*b*) of debentures dated May 28th, 1903, securing £500, and (*c*) of debentures dated May 6th, 1904, securing £1,200 (all notified May 24th, 1918). Also registered: Assignment on May 16th, 1918, of process of two Government contracts, to secure all moneys due or to become due to London County, Westminster & Parr's Bank.

Tees Power Station Co., Ltd.—Particulars of £600,000 6 per cent. first mortgage debentures created by resolutions of March 18th and May 7th, 1918, and secured by trust deed of last date, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued at 94 per cent. Property charged: Freehold land at Billingham, Durham, with buildings, &c., thereon, or to be placed thereon, benefit of covenant by Newcastle-upon-Tyne Electric Supply Co., Ltd., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd.

F. A. Jennings, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, and machinery, plant, fixtures, fittings, tools, stock in trade and utensils of trade, to secure £5,000. Holder: E. Pedduck, 31, Cannon Street, E.C.

Thermo-Electric Ore Reduction Corporation, Ltd.—Mortgage dated May 23rd, 1918, to secure all moneys due, or to become due, from company to London County & Midland Bank, Ltd., Threadneedle Street, E.C., charged on property at Luton.

Manchester Fibrine Co., Ltd.—Memorandum of satisfaction in full on April 20th, 1918, of debentures dated July 4th and 8th, 1913, securing £400, has been filed.

Church Stretton Electric Supply Co., Ltd.—Particulars of £300 debentures created May 21st, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property and assets, present and future, including uncalled capital (subject to existing charges). No trustees.

Yorkshire Electric Wiring & Motor Co., Ltd.—Mortgage on leasehold premises at Sheffield, &c., dated May 4th, 1918, to secure all moneys due, or to become due, from the company to London County & Midland Bank.

CITY NOTES.

Siemens Bros. and Co., Ltd.

Mr. G. Mure Ritchie presided on Tuesday, at Winchester House, E.C., at the annual meeting of this company. The annual report, which was adopted, showed that the profit for 1917, after payment of all loan and debenture interest, was £213,524, before allowing for munitions levy and excess profits duty. Dividend 10 per cent., free of tax (against 7 per cent.), paid in January last, and £209,890 is carried forward, against £61,365 brought in. Cash position:—Sundry debtors, &c., £461,783; cash and Treasury bills, £125,120; investments in Siemens Bros. Dynamo Works, Ltd., £400,000; other investments, £56,085; materials, manufactured goods, and work in hand, £764,524; total, £1,807,512. Less debts and loans, £1,155,838; surplus, £651,674.

The chairman said that they met at a juncture of no small importance in the financial and industrial history of the company, and he was pleased to meet them for the first time as chairman of Siemens Bros. & Co., Ltd., which was one of the oldest—if not the oldest—electrical manufacturing firms in the United Kingdom, the business having been started as far back as 1858 in Millbank Row, and there employing about 100 men. In was incorporated with the larger factory at Woolwich in 1865, and had now grown to large dimensions. The past policy of the company had been continued throughout 1917, during which the business exceeded that of 1916 by about one-third, and, of course, like all other large engineering firms, they were engaged almost exclusively on war work. The expansion in output occurred principally in insulated wires and cables, ebonite and batteries, but also the development in automatic telephony, which was foreseen by this company before the war, was continued on a considerable scale. They were equipped to provide both large exchanges for public service and smaller private exchanges of 25 to 500 lines, and, notwithstanding the demands upon them for war work, they had found it possible to complete a semi-automatic exchange at Port Adelaide (1,000 lines) for the Commonwealth of Australia, which had been working quite satisfactorily for 18 months, and a full automatic exchange for Grimsby (1,300 lines) for the General Post Office, which would very shortly be handed over, and to make good progress with a full automatic exchange for Stockport (950 lines), also for the General Post Office. Many private exchanges of from 25 to 200 lines had been established in munitions factories. Some 1,154 of the company's employés had joined the Colours, and these included the only son of Mr. George Chauvin, their managing director. The expansion of the business had caused a considerable increase in the number of employés. Whereas before the war they employed about 4,000 persons, of whom 1,100 were females, the number was now over 5,600, including 2,600 females. The proportion of males to females, which before the war was three to one, was now about equal. Their relations with the staff and workpeople had been and were good. Proof of the happy relationship existing between the company and its employés was afforded by the long service of many of them. A continuous service of 50 years with the company was not uncommon—in fact, three had reached their jubilee of service with the company this year. The profit of £208,525 showed a substantial increase over that of the preceding year, attributable to the very much larger volume of business done. An interim dividend of 10 per cent., free of income-tax, had been paid, but no further distribution for the year 1917 could properly be considered until the Government claim for excess profits duty had been adjusted. After obtaining the opinion of Sir John Simon, K.C., they found it necessary to reconstruct the accounts of the Dynamo Co. for 1914, 1915, and 1916, a matter involving considerable labour and time, which delayed the completion of the Dynamo Co.'s accounts for 1917. There were other matters also affecting the assessment to excess profit duty which had to be dealt with. In the balance sheet the most important item on the assets side was the entry of £764,524 for materials, manufactured goods, and work in hand. This was more than double the corresponding pre-war amount, which at December 31st, 1913, was £377,385. The increase was due entirely to the growth of expenditure on orders in hand, the value of which exceeded a million and a half at December 31st last. Another important item among their assets was the company's holding of the whole of the issued capital of Siemens Bros. Dynamo Works, Ltd., namely, £200,000 in shares and £200,000 in debentures. At the outbreak of the war the share capital of this company—that is, Siemens Bros. & Co., Ltd.—amounted to £600,000, with £150,000 in 4 per cent. debentures ranking in priority thereto, nearly all the shares and about one-third of the debentures being held by Germans. Moreover, the German shareholders had supplied about £1,350,000 of additional capital to meet the requirements of the growing business of Siemens Bros. and Co. and Siemens Bros. Dynamo Works. In accordance with the provisions of the Trading with the Enemy Amendment Act, 1916, the whole of the German interest in the shares and the additional capital before mentioned was vested in the Public Trustee, who took steps to realise it by sale to a British buyer. Tenders were called for, and considerable interest in the sale was aroused. On December 14th, 1917, a sale was effected of the share capital of Siemens Bros. to Messrs. C. B. Crisp & Co. An important provision of the contract of sale was the issue to the Public Trustee by this company of debentures to the amount of £1,330,000, to bear interest at the rate of 4½ per cent. per annum, in order to provide for the repayment of the capital (other than share capital and the participation in the 4 per cent. debentures) employed in the business by the former German proprietors. The company agreed with the Public Trustee that he should have the right, after the conclusion of Peace, to call upon the company at one year's notice to redeem such debentures. Subject to such arrangement they were redeemable by annual drawings calculated to extinguish the whole in 25 years from the date of their issue. The issue of these debentures to the Public Trustee replaced in the company's books the German portion of the item of £1,155,838 shown in the balance sheet now in their hands, and other sums owing by the Siemens Dynamo Co., which were not disclosed in the balance sheet, but which would duly appear in that of the Dynamo Co. On the completion of the arrangements between the Public Trustee and the British purchasers of the German-owned shares the board was reconstituted, and was now composed of the following:—Mr. G. Mure Ritchie (chairman), the Rt. Hon. Sir William Bull, M.P., Sir Clifford Cory, Bart., M.P., the Rt. Hon. Lord Queenborough, Mr. H. J. Thomas, and Mr. G. Chauvin, the last-named being the managing director. Since the new board was formed attention had been given to many questions concerned with the development of Siemens Bros. into a great national manufacturing asset, and little time had been available for discussing a scheme of rearrangement of the share capital. The subject had, however, been under consideration, and the board recognised the advisability of so changing the capital arrangements as to make them conform with the ordinary practice of British companies. Equilibrium must be established between the share capital and the debentures, and with this object the board might at an early date ask the shareholders to approve a scheme for enlarging the share capital to £1,500,000, or to an even greater sum, in shares of £1 each. Of that number a substantial portion would remain in reserve for future developments, but as to 400,000, if issued for cash, the proceeds would be available for the retirement of a corresponding amount of debentures, thereby anticipating, in part, the post-war contingency which confronted the company. If the matter be carried through on the lines now roughly indicated, the joint concerns—that was, Siemens Bros. and Siemens Dynamo Works—would be represented by an issued share capital of £1,000,000, a debenture issue of £150,000 carrying interest at 4 per cent. per annum, and the second debentures issued to the Public Trustee, amounting to, say, £1,000,000, carrying interest at 4½ per cent. per annum. These readjustments were all subject to negotiations which must be conducted with the authorities concerned, but he thought that, as the Board of Trade desired that the company should be so assisted in its developments as to ensure its future expansion in British hands, they were justified in believing that sympathetic consideration would be given by the authorities to their proposals for the financial reconstruction of the company when they were put forward. Coming to Siemens Bros. Dynamo Works, Ltd., which, as already stated, was entirely owned by Siemens Bros. & Co., the main features of the Dynamo Co.'s trading for 1917 as compared with 1916 was an increased turnover in the United Kingdom and a decrease overseas. The value of unexecuted orders at December 31st last was £1,145,000. The Dynamo Co., in association with Siemens Bros. & Co., had purchased £50,000 of War Loan, and had given temporary financial assistance to the extent of several thousands of pounds to War Savings Associations among the employés. Prior to the war the Dynamo Co. employed 3,389 persons, of whom 328 were women. It now employed 2,439 persons, including 650 women. Thus the proportion of men to women, which before the war was 10 to one, was now about four to one. Since the entry of the new directors into office, negotiations had been set on foot with other British companies doing similar industrial business with the object of bringing such manufacturers together for the reduction of unnecessary competition, and the avoidance of duplicating machinery, staffs, workshops, and offices. Such co-operation would make for the more continuous running of plants, the employment of more labour, and greater regularity in the volume of such employment, with the attendant advantages of cheaper production, increased efficiency, and improved quality. It meant the avoiding of unnecessary expense in storage and in selling organisations, and reduced to a minimum the duplication of stocks. An even more important advantage aimed at was the amalgamation of designing offices and the interchange of the accumulated experience of all the participants, their designs and methods. This, again, meant reduction of expenditure and increase of efficiency. The advantages arising from such industrial alliance would, moreover, make it possible to carry out complete installations within the allied group. Alliances of this nature had already been arranged with Messrs. Dick, Kerr & Co., Ltd., in the field of dynamo installations in all its ramifications, and other alliances were in contemplation. From the earliest days scientific research and experimental work of a high class had been a feature of this business. The staff of Siemens Bros. & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., contained about 25 university men, and it would be a feature of their policy to encourage the employment of men of that class, because they all recognised that in the future, far more even than in the past, they would be in an era of the more scientific development of industry.

Delhi Electric Tramways and Lighting Co., Ltd. During 1917 the gross receipts of the tramway undertaking were £13,343, and those of the electric supply undertaking £25,785, representing increases of 20 per cent. and 12½ per cent. respectively over the figures for 1916. The net revenue of the combined undertakings was £15,119, against £11,593 in 1916. As present conditions have increased all items of expenditure and necessitated restrictions, the increase is regarded as satisfactory. After meeting expenses, paying debenture and loan interest and Indian income-tax, also putting £5,000 to depreciation of plant and equipment and £1,500 to reserve for renewals, the profit is £4,419, plus £1,089 brought forward. A dividend of 4 per cent., less tax, on the preferred shares is to be paid, and £1,508 carried forward. The plant and equipment, including rolling stock, have been maintained in good condition, notwithstanding difficulties of obtaining spare parts of all kinds, and the cost has been charged to revenue. Plant additions during 1917 cost £8,964. The new 350 B.H.P. Diesel engine was put into operation in April 1918. Increased demand for current during the winter necessitated the working of the plant under unfavourable conditions. The situation was met without undue hardship to consumers. The provision of other necessary plant, equipment and mains must remain in abeyance for the present.

Anglo-Argentine Tramways Co., Ltd. The report for 1917 shows that the receipts were £2,783,412, and the working expenses £2,051,746, leaving £731,665, plus interest on investments, &c., £38,321, and £50,969 brought forward. Annuity to the City of Buenos Aires Tramways Co. (1904), Ltd., absorbs £70,660, interest and sinking funds on debenture stocks £587,821, sinking fund for redemption of preference and ordinary shares £6,485, interim dividend on 5½ per cent. cum. first pref. shares for half year ended June, 1917, £88,000, leaving balance of net revenue carried to 1918 £67,990. The traffic receipts for 1917 showed an increase of £47,776, and the passengers carried were 324 millions odd, an increase of 5,811,811. The abnormal cost of fuel continued during the year, and the electric traction expenses, were £639,541, which, after allowing for the additional mileage run, is £273,734 in excess of what these expenses would have been if the cost of fuel had continued on the pre-war basis. In all other items of expenditure the strictest economy continues to be exercised. Capital outlay on works has been restricted to £41,213. In view of the uncertainties regarding the provision and cost of fuel, owing to the scarcity of tonnage, the heavy ocean freights, and the decrease of labour, the directors are unable at present to recommend the distribution of a final dividend on the cum. first pref. shares for the second half of 1917. A tribute is paid to the able management of Mr. Pedriali, and to the loyalty of his staff, which have enabled the tramway services to be continued, notwithstanding great labour unrest in the Argentine. The general manager reports on the outlook as follows:—

> There are good prospects as to a revival of business in general, consequent upon the settlement of the purchase by the Allied Governments of our excess crops at fixed minimum rates, and the opening of large credits in favour of the British and French Governments. The results of this excellent arrangement, and the abundant grain harvests and improved general prospects are that business has improved all round and upon a sound basis, and although there is a lot of leeway to make up, there is no doubt that affairs have decidedly taken a turn for the better. The number of empty houses and flats has decreased. We are already beginning to feel the effects of this improved state of affairs on our traffic. Expenses per car kilometre, always excluding the cost of current, will be kept down to below the level of last year, in spite of considerable increases allowed to some of our workmen, and reduction in working hours. Of course, the price of current is the one unknown quantity in these times, and will, I am afraid, be higher than ever this year.

Kalgoorlie Electric Power & Lighting Corpn., Ltd.—During the year the cost and difficulty of carrying on the business have been continuously cumulative. The effects of the shortage of labour and of shipping are more evident and more felt as the months and years go by. Prices of all requisities are higher, and it is difficult to get some essential things shipped at all. The profit amounts to £15,911, a decrease of £2,907, which is rather less than was anticipated. £6,000 was distributed as preference dividend, and £6,000 was placed to the credit of the debenture redemption fund. The debenture debt has been reduced from £61,200 to £30,000, and a further reduction of £7,500 has to be made at the end of this year. In view of this obligation, the directors were unable to recommend the payment of a dividend on the preference shares in April last. The balance sheet now shows that the sum carried forward is insufficient to permit of any further dividend being paid until the profit of the current year has been ascertained, and provision made for debenture interest and repayment, and for heavier claims for income-tax. The property has been maintained in good condition, and the plant and machinery in thorough working order. No important consumer has ceased to take current, but nearly all customers are taking less than before the war.

New General Traction Co., Ltd.—For the year ended March 31st the revenue amounted to £18,575. Profit £11,040, plus £8,070 brought forward, making £19,110. The directors recommend a dividend of 4 per cent., less tax, carrying forward £8,630. A dividend of 2 per cent. was paid by the Norwich Electric Tramways Co. for the year ended June 30th, 1917. The Douglas Southern Electric Tramways system is still closed down on account of the war. The income received from the Philadelphia undertaking for 1917 amounted to £13,859 after deduction of American income-tax.

Bombay Electric Supply & Tramways Co., Ltd.—Total revenue for 1917, including sale of current to the tramways, £439,850, an increase of £65,383, or 17.77 per cent. Total expenditure £183,457, an increase of £26,769, or 17.08 per cent. Net receipts £256,393, an increase of £39,614, or 18.27 per cent. After paying debenture interest, putting £43,333 to depreciation, providing for excess profits tax, and contributing to the provident fund, 6 per cent. is paid on the pref. shares, and 10 per cent., plus a bonus of 4 per cent., free of tax, on the ordinary shares, leaving £6,768 to carry forward, after paying a month's pay to officers and employés by way of a bonus, absorbing £4,900.

United River Plate Telephone Co., Ltd.—The gross earnings for 1917 were £793,670, and the gross maintenance and other charges in Argentina and London were £528,252, leaving £265,418 profit. After paying debenture interest, preference dividend, and a total of 8 per cent. for the year on the ordinary shares, free of income-tax, £2,000 is put to the staff provident fund, £60,000 to reserve, £40,000 to reserve (war contingencies) fund, and £17,308 is to be carried forward.

British Insulated & Helsby Cables, Ltd.—According to a financial daily, at an extraordinary meeting held at Liverpool last week, a resolution was unanimously passed providing for alterations to the articles of association so as to enable the directors to capitalise the undivided profits, and to distribute them among the shareholders in the form of ordinary shares.

Submarine Cables Trust, Ltd.—For the year to April 15th revenue amounted to £27,694, and expenses to £1,773, leaving £25,921. After providing £14,802 to meet payment of coupons, £11,093 has been transferred to redemption fund, leaving £93 to be carried forward.

Calcutta Tramways Co., Ltd.—Final dividend 5s. 6d. per share, making 8 per cent. for the year, free of tax; to reserve for depreciation, &c., £25,000; to staff provident fund, £1,299; carrying forward, subject to excess profits duty and Indian super-tax, £8,434.

Telephone Co. of Egypt, Ltd. — The "Times" states that the directors have announced their intention of redeeming the outstanding 4½ per cent. debenture stock on November 30th at the redemption price of 107½ per cent.

Vulcan Boiler & General Insurance Co., Ltd.—Interim dividend 9 per cent. (1s. 6d. per share), less tax, on ordinary shares.

Brazilian Traction, Light & Power Co., Ltd.—Quarterly dividend 1½ per cent. on the cum. pref. shares.

Yorkshire (Woollen District) Electric Tramways, Ltd.—Revenue for 1917 £81,585, against £76,110 for 1916. To renewals fund £10,600, to reserve £5,611, 6 per cent. dividend or ordinary shares, carry forward £5,129

Brush Electrical Engineering Co., Ltd.—Dividend on ordinary stock for years 1916 and 1917, 6 per cent. per annum; to depreciation £7,331 and £699, general reserve £12,674, carried forward £12,700.

STOCKS AND SHARES.

Tuesday Evening.

Industrials claim the most attention in the Stock Exchange. Other markets are steady, and there is more business doing than there has been lately, but dealing conditions do not get easier. Money absorption by the National War Bonds, added to the settling-up of their affairs by middle-aged men who expect to be called up sooner or later, continue to be deterrents to fresh enterprise, so that the man who buys, equally with the man who sells, tends to feel dissatisfied with the prices at which his agents carry out his orders, he not grasping the increasing difficulties that attend negotiations of stocks and shares. The news from the Western Front continues sufficiently serious to add an element of discouragement to activity in the House. Once more it must be noted that far more interest centres upon Conduit Street, the White City, Holloway Road, and other similar places now well known to Londoners of the new military age, than does Throgmorton Street.

The Electricity Supply market is dull, shares being disposed to give way where they move at all. Bromptons are 5s. down, and so are "City Lights." St. James's and Metropolitans are both ⅛ easier. The two County of London issues, however, are nominally advanced. The reason given in the Stock Exchange for the depression which has overspread the list as a whole is that there are two or three deceased accounts overhanging the market, and that the lines of shares in these are rendered more difficult to place by reason of the caution induced by the rationing of electricity to householders. Those companies which depend largely upon their power business are naturally less likely to feel any ill-effects from this cause than are those which concern themselves chiefly with domestic lighting. Circles which are well informed claim, however, that the reduction of one-sixth in ordinary lighting is not likely to make much difference to the profits of companies engaged in supply, but, of course, until this is verified, it can hardly be expected that the average investor will be tempted to buy electricity shares. Meanwhile, it may be noted that the City Co. announces a further increase in price to its consumers: the new rate will be 50 per cent. higher than that prevailing on the outbreak of war.

The Manufacturing group is firm. The Brush report, commented upon here last week, has had a good effect. The gross profit is over £20,000 up, and expenses rose £2,600, while the company has wisely set aside £15,500 for maintenance, which is nearly £6,000 more than last year. The general reserve gets £12,700, an increase of £5,600, and, as mentioned before, the Ordinary stock will have a dividend of 6 per cent. for each of the years 1916 and 1917. The Ordinary stock has not changed hands since the issue of the report, the nominal price being 55—65, and the last business being marked at 44 a month ago. The 4½ per cent. Second Debenture stock, which, of course, will receive its interest at the end of this month, is quoted 49-52, so that the yield comes out to over 9 per cent. on the money. The First Debenture stock stands at 60½, and the 5 per cent. Prior Lien Debenture stock at 75, though in the case of all the issues there is little stock on offer. The Calcutta Tramways Co. has declared a dividend, making 8 per cent. free of tax for the year, comparing with 9½ per cent., less tax, for the previous twelvemonth. This, of course, is an improvement, and the Ordinary shares have risen to 7, the Preference being 4, and the 4½ per cent. First Debenture stock 73. A slight recovery in London United Tramways 4 per cent. Debenture stock raised the price to 38.

One of the features in the industrial market is a sharp rise in Marconis, the price putting on 5s. at 3⅜. No explanation was forthcoming in the market, except an expectation that the Marconi Marine Co., in which the parent concern is largely interested, is on the point of publishing an excellent report. Marines rose to 2⅝, Americans are better at 23s., and Marconi Preference at 2¾ are ⅛ higher.

Cable stocks and shares have again improved upon their previous rises. Eastern Extensions have risen to 15¾, bringing them level with Western Telegraphs, and Easterns at 158½ are a point up, standing thus much higher than the shares of the two companies just mentioned. Indo-Telegraph gained another 10s., and other members of the group are very firm. United River Plate Telephone have improved to 7 5/16, and Chile Telephones hold the gain of 10s. acquired last week. West India & Panama Firsts hardened to 8¼. In the manufacturing list, Henleys at 21 are 5s. higher, General Electric Ordinary at 21½ are 15s. up. India-Rubber shares have again spurted, a rise of 12s. 6d. taking the price to 16¼. Amongst the engineering shares, Babcock & Wilcox have recovered to 3⅝. Iron and Steel shares generally are harder, and there is a very good tone about the market as a whole.

The home railway list keeps steady, without, however, sufficient business occurring to affect quotations to any appreciable extent. Districts put on another ½ at 15½, the fare-raising possibilities being regarded as the reason for the slight demand for the stock, and Metropolitans at 20¾ have replaced the fraction which they shed last week. Underground Electrics have not moved.

The Anglo-Argentine Tramways Co. has done badly on account of the abnormal cost of fuel, and the report is distinctly disappointing. The company postpones the final dividend on its First Preference shares, thereby dashing the hopes of those who had expected the company to make a better showing in respect of the last six months. No changes have been marked against the company's issues, but the market, of course, is not so firm as it was. Brazilian Tractions subsided a point. On the other hand, British Columbia stocks are rather better, both the Preference and Preferred improving. Mexicans hold their recovery, and the various Brazilian Tramway bonds are also steady at the advanced prices.

Notwithstanding the further reduction in the price of rubber, rubber shares are generally harder, buying from the provinces having a good effect upon an oversold market. The armament shares also are better, on the idea that official details will be published almost at once in connection with the merger between the undertakings engaged in explosives. Of base-metal shares, the best showing continues to be made by those in the New South Wales group. There is not much doing in the shares of the companies connected with tin and copper.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price June 11, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6⅛	— ¼	£7 13 10
Charing Cross Ordinary	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref...	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3	—	8 6 8
City of London	8	8	11⅛	— ¼	6 19 2
do. do. 6 per cent. Pref. ..	6	6	9⅞	-	6 0 4
County of London	7	7	10½	+ ⅛	6 13 4
do. do. 6 per cent. Pref.	6	6	10	+ ⅛	6 0 0
Kensington Ordinary	6	7	5¼		6 13 4
London Electric	Nil	Nil	1⅛		Nil
do. do. 6 per cent. Pref...	4	5	3¼	—	7 13 10
Metropolitan	3	4	3⅛	⅛	6 8 0
do. 4½ per cent. Pref. ..	4½	4½	3¼		6 13 4
St. James' and Pall Mall	8	9	6⅞	-	6 11 0
South London	5	5	2 13/16	—	7 2 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	•9	6¼	—	7 3 10

Telegraphs and Telephones.

	Dividend 1916.	Dividend 1917.	Price June 11, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	94		6 7 8
do. Def. .. .	1½	1½	22		6 14 10
Chile Telephone	8		8¼	—	4 17 0
Cuba Sub. Ord.	7	7	9¾	-	*7 3 7
Eastern Extension	8	8	15¾	+ ⅛	5 1 7
Eastern Tel. Ord.	8	8	158½	+1	5 1 0
Globe Tel. and T. Ord.	7	—	15	+ ¼	'4 13 4
do. do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel. . ..	24	22	38	—	5 15 9
Indo-European . ..	13	—	49⅛	+ ½	6 5 1
Marconi	15	—	3⅜	+ ¼	4 17 10
Oriental Telephone Ord.	10	—	4 3/16	—	2 7 9
United R. Plate Tel.	8	8	7 5/16	+ ⅛	'5 9 4
West India and Panama	6d.	9d.	1⅛	—	*3 6 8
Western Telegraph	8	8	15¾	—	*5 1 7

Home Rails.

	Dividend 1916.	Dividend 1917.	Price June 11, 1918.	Rise or fall this week.	Yield p.c.
Central London Ord. Assented ..	4	4	62½	—	6 8 0
Metropolitan	1	1	20¾	+ ¼	4 16 5
do. District	Nil	Nil	15½	+ ½	Nil
Underground Electric Ordinary..	Nil	Nil	1¾		Nil
do. do. "A" ..	Nil	Nil	5/-	-	Nil
do. do Income ..	6	4	76½		'5 4 7

Foreign Trams, &c.

	Dividend 1916.	Dividend 1917.	Price June 11, 1918.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾		6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3		—
do. do. 2nd Pref. .	5½	—	2½	—	-
do. do. 5 Deb. . ..	5	5	63	—	7 18 10
Brazil Tractions			42	1	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	61½	+1	8 2 8
do. do. Preferred	Nil	Nil	43½	+1	Nil
do. do. Deferred	Nil	Nil	35	—	Nil
do. do. Deb. ..	4¼	4¼	63		6 15 0
Mexico Trams 5 per cent. Bonds .	Nil	Nil	37½		Nil
do. 6 per cent. Bonds..	Nil	Nil	30		Nil
Mexican Light Common	Nil	Nil	20	--	Nil
do. Pref. .. .	Nil	Nil	26¼	—	Nil
do. 1st Bonds.. ..	Nil	Nil	37½		—

Manufacturing Companies.

	Dividend 1916.	Dividend 1917.	Price June 11, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3⅝	+ 1/16	4 9 0
British Aluminium Ord. . ..	10	10	1 11/16	+ 1/32	5 18 6
British Insulated Ord. .: ..	20	20	3¾	—	5 6 8
British Westinghouse Pref. ..	7½	7½	2 5/16	—	6 9 4
Callenders ..	20		17¼	--	5 16 0
do. 5 Pref. .	5	5	4	—	6 5 0
Castner-Kellner .. .	22	20	3 5/16		6 0 10
Edison-Swan, fully paid .	—		2⅝		Nil
do. do. 4 per cent. Deb. ..	4	4	75½	—	5 6 0
Electric Construction	7½	10	1 5/16	-	7 12 4
Gen. Elec. Pref.	6	6	10¼	.	5 15 8
do. Ord.	10	10	20½	+ ¾	4 13 0
Henley	25	25	21	+ ¼	5 19 1
do. 4½ Pref..	4½	4½	3¾	.	5 12 2
India-Rubber	10	10	16¼	+ ⅝	6 3 1
Telegraph Con.	20	20	42½	—	'5 13 0

Dividends paid free of Income Tax.

INSTRUMENTS FOR CENTRAL-STATION SWITCHBOARDS.

By G. W. STUBBINGS.

The switchboards of a modern central station giving D.C. low-tension, E.H.T., and traction supplies are an exceedingly important section of the whole plant, and in works of even moderate output will occupy considerable space. The function of a switchboard is of a dual character, in that on it are assembled both the switch and control gear, and also the measuring instruments. The number of these latter is considerable, and their cost is a large percentage of the total cost of the whole switchboard. It is, therefore, desirable to know with some amount of certainty the degree of accuracy requisite with instruments for certain specific purposes. Instruments with accuracy superior to that required for their purpose will increase the cost of the switchboard without any corresponding advantage being obtained, while the provision of instruments of accuracy inferior to that called for by circumstances will be even more undesirable, and the consequences of such lack of accuracy may be far-reaching.

The majority of switchboards, as a rule, contain a larger number of ammeters than of any other type of instrument. Ammeters are frequently the only instruments on large feeder switchboards. For feeder panels it seems very clear that a high degree of accuracy is not called for, only an approximate indication of the current being required. Indeed, it may be said that current is not a quantity required to be known more than approximately in central-station work. For this reason it seems clear that a cheap type of ammeter will serve all the purposes required on the central-station switchboard. Such instruments should, of course, be dead beat; but dead-beatness, at one time confined to instruments of the moving-coil type, is now obtainable with moving-iron instruments. The accuracy of these latter instruments cannot, perhaps, be checked so easily as that of shunted ammeters; but if the resistance of the instrument is known a very good check can easily be obtained by taking the drop across the terminals of the instrument with a good, high-resistance millivoltmeter.

Switchboard voltmeters require a greater degree of accuracy than ammeters. The voltage of supply being prescribed by authority, and definite deviations only being allowed, the voltmeters connected to the feeder pilots should be of good quality. It is a good practice to have these voltmeters duplicated. One pair, in the case of three-wire systems, could be of large size, easily read some distance away, while the duplicate voltmeters could be of the electrostatic type. The accuracy of the feeder voltmeters can by this means always be kept under observation. For paralleling D.C. machines, zero volt indicators are in common use, and the question of accuracy in the ordinary sense does not apply in the case of such instruments. They should, however, be of good construction.

Indicating wattmeters and power-factor meters on E.H.T. control switchboards are now of standard type. The degree of accuracy required with an indicating wattmeter is of the same order as that called for in a D.C. machine ammeter. Power-factor meters of modern design are very accurate. Little need be said regarding frequency meters.

The degree of accuracy desirable in integrating watt-hour meters is debatable. For ordinary purposes, on generating units, this would not seem to be very high; but, on the other hand, for purposes of steam consumption and other works tests an exceedingly good instrument is called for, if results worthy of the name are expected. Money spent on thoroughly reliable and accurate watt-hour meters for main switchboards will not, as a rule, be wasted, but will be well laid out. For D.C. work, commutator meters of the motor type have been largely used. It is essential that these be of the astatic type, owing to the considerable stray fields arising from the heavy current flowing near the meters. Mercury watt-hour meters have been used on main switchboards to a limited extent. Apart from the inherent limitations of a mercury meter, these instruments would seem to be specially unsuitable for use in an engine-room where the temperature is high, experience showing that the amalgamating action of the mercury on the copper armature disk of the meter is rapidly accelerated by heat. With meters of both the commutator and mercury types, the accuracy, apart from solid friction, depends upon the constancy of the brake magnets. No meter depending for its accuracy upon this constancy can be reckoned to be permanently accurate, and, in view of the comparative difficulty of testing and adjusting switchboard meters, it seems desirable that meters not suffering from the limitations mentioned be adopted. Aron clock meters are excellent for switchboard use, in that their calibration, depending as it does on physical constants that may be considered quite permanent, can hardly alter. Where meters of this type are used, permanent accuracy can be relied upon, provided, of course, that the meters are free from mechanical defects. Such defects, it may be remarked, are usually perceived immediately with clockmeters, as the readings of the meter become inconsistent at once, and do not alter gradually, as in the case of meters of the motor type.

Induction meters are in common use for A.C. switchboard use. These instruments now give a high degree of accuracy, and have been found very satisfactory for this purpose. For three-phase work, the usual single meter, with two elements and one spindle and counter, is usually employed. In the course of the discussion of Messrs. Ratcliff and Moore's paper on "Electricity Meters," before the Institution of Electrical Engineers, in 1911, Mr. W. B. Shaw suggested that two single-phase meters should be used for metering three-phase power on main switchboards. There is a good deal to be said for this suggestion. Although the ordinary three-phase meter for unbalanced loads will accurately integrate energy, it is, from the point of view of possibility of failure or inaccuracy through mechanical friction, only a single meter. By using two single-phase meters it is possible, in the case of failure of one of the meters, to estimate the total energy, knowing the power factor, by reason of the definite relationship existing between the ratio of the readings and the power factor when the circuit is balanced. As the average power factor can be obtained with a considerable degree of accuracy, it is possible at any time to obtain a fair check on the accuracy of the two instruments, and also to detect in good time any falling-off in the accuracy of one of them. Objection has been raised to this method on the ground that, at fairly low power factors of the whole circuit, one of the meters will be working at a power factor very much less, possibly in the neighbourhood of zero. It may be pointed out that in this case the meter working at the low power factor will be metering a very small proportion of the total energy, and even though it be working inaccurately, such inaccuracy will have but a small effect upon the accuracy of the combination. Apart from this theoretical reason, the objection is of small importance, in that usually it is possible in modern central stations to keep the power factor of the system in the neighbourhood of unity. Induction meters are, of course, subjected to the same limitations as D.C. meters of the motor type, in that they depend for their prolonged accuracy upon the constancy of the brake magnets. Meters of the Aron clock type are therefore preferable for A.C. as well as for D.C. work if the highest accuracy is desired.

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In conclusion, it may then be said that ammeters or indicating wattmeters are required only to give the load on a machine or in a feeder approximately, and, therefore, do not need to be of the highest accuracy. Voltmeters, as a rule, are required to give an accurate indication, and with them a higher class construction is desirable. Integrating wattmeters give the final result of the conversion of the potential energy of the coal into electrical energy, and if the efficiency of this conversion is desired to be known with certainty, and if the performance of the generating sets be desired to be kept under close supervision, the accuracy of these instruments should be of the highest possible, and such accuracy should, apart from mechanical failure, be maintained for an indefinite time.

France.—A new company has lately been formed with a capital of £40,000, and the title La Société Tréfilerie et Câblerie, to acquire and carry on the wire and cable works of Messrs. Bailly, Chaudouet, Desvoyod & Co., at Bourg-en-Bresse (Ain).

THE CONTROL OF LARGE AMOUNTS OF POWER.

Mr. E. B. Wedmore read his paper before the Manchester Local Section of the Institution of Electrical Engineers on March 12th. An abstract of the paper appeared in the Electrical Review for March 15th, 22nd, and 29th.

Mr. G. A. Juhlin said the author had given certain values of the short-circuit current, but had not made it clear exactly what those values meant. The maximum short-circuit current indicated by the curves was 10 times the normal current. It was not clear whether the author had considered a symmetric or an asymmetric short-circuit. If the latter was the case, the values appeared to be too low. It seemed essential that some definite basis should be laid down in giving these values, for if manufacturers were asked to state short-circuit currents, and one gave the R.M.S. values and assumed a symmetric short-circuit, whereas another gave the maximum possible peak value, the latter would be approximately 2.5 times as great as the former, assuming the machines in question to have the same reactance. While he agreed that it was not at present possible to limit faults between phases, they had at least protective gear which would cut out apparatus that had failed between phases, but they were still without means of cutting out either a generator or a transformer which might develop a short-circuit between turns. It was of great importance to protect machines from destruction by fire, and a scheme with this aim in view consisted of providing dampers in the air ducts of the machine, which could be tripped automatically by the Merz-Price or any other protective gear that might be installed. The air supply would then be cut off immediately a fault occurred in the generator, and thus prevent the total destruction of the winding by fire.

Mr. A. E. McKenzie thought the author was right in stating that for some few years to come we should have to content ourselves in this country with generators of 20,000 and 30,000 KW. Regarding the inherent regulation of generators, to-day the power load predominated to such an extent that machines having coarse regulation and short-circuit currents of comparatively low value were preferred. Automatic voltage regulators would be found quite unnecessary. Faults on generators invariably started between turns of the same phase winding, and then went to earth before developing between phases. Every generator should be protected by balanced protective gear, with a device for disconnecting the main field immediately the main switch was opened. He was not in agreement with Mr. Juhlin as to the necessity for automatically closing the air dampers on the outlet and inlet sides of generators. Regarding the provision of a second line of defence, at Stuart Street station, during the last 10 years only in three or four cases had one of the main group switches operated, but if it had not operated there would have been a severe switchgear breakdown on each occasion. Limiting the cross-section of the smallest conductor was most important on large feeder systems.

Dr. W. Cramp said the term "reactance" was used almost throughout the paper in a wrong sense. Obviously the author meant "impedance." The principles upon which the values given in the paper were arrived at needed explanation. The author should consider maximum currents and instantaneous conditions; whereas he seemed to assume only R.M.S. currents and steady conditions. He neglected entirely the effects due to capacity, self-induction, and leakage of the line. The important function of the impedance in enabling the oil switch to open the circuit was neglected by Mr. Wedmore, although it was of great importance in deciding the amount of impedance desirable. With regard to the use of chokers containing iron, had the author ever considered the possibility of a core with an air-gap so arranged that when the current exceeded a pre-determined figure the gap would close, and a much larger reactance be automatically put in circuit? Also, had he any knowledge of the use of Hilliard's switch, which on the occurrence of a short-circuit put a choker into operation?

Mr. J. Denham asked what was the number of K.V.A. actually broken in an oil switch relatively to the K.V.A. produced by the generator. Was it too much to expect from the users of medium and large oil switches that on the occasion of a short-circuit they might note the particulars needed to arrive at the approximate value of the short-circuit? If this information, together with details of the type of switch, were sent to the manufacturer, he could fill in other details, and the whole of such records over, say, a year or so, published by the Institution (with the consent of users and manufacturers) would prove of the utmost benefit.

Mr. W. de M. Landon asked whether it was not time, in large cities, to construct subterranean passages where feeders could be inspected from time to time, and where an inspector could travel equally as freely as if on the street surface. He agreed with Dr. Cramp on the question of reactances.

Mr. S. Ferguson said reactances were destined to play a very important part in the large schemes now contemplated. He thought a combination of generator, feeder, and bus-bar reactances would be the ultimate scheme adopted in large stations. He showed curves illustrating the effects of bus-bar reactances in a medium-sized station by which it was seen that the adoption of 12½ per cent. reactance reduced the initial energy output and the initial short-circuit current to about one-half, thus reducing the mechanical stresses to one-quarter. This result was accomplished with reactances having an energy loss of about 3 KW. for each single-phase unit. The cost was only 3 to 4 per cent. of the capital value of the plant, and the space occupied for each coil about 5 ft. diameter and 4 ft. high. It was evident that a very big insurance of the plant was effected at comparatively small cost. All engineers should get to know what was the average inherent reactance of their plant, and forward that information to their switchgear suppliers, so that they might estimate what initial short-circuit current might be expected at any particular point in the system. He thought that in switching a transformer in and out of circuit it was desirable whenever possible to energise it and de-energise it on the low-tension side. He hoped that ere long they would have British rules for oil switches which would guide purchasing engineers in their selection for any particular duty. German rules had existed for a number of years, but they were out of date in that they ignored some very important factors.

Mr. J. L. Thompson thought the author had had very little experience of the ironclad reactance, or he would not have made such a sweeping statement as that "there is no gain in the use of iron in the design." The straight line characteristic up to maximum possible fault current was attained in the ironclad type. The chief claim made for the air-core reactance was that it had a straight line characteristic; while this was true, it had possible disadvantages. In comparison, the ironclad type had no stray field, and hence could be oil insulated and mounted in a tank, and could be placed in any position that a transformer could occupy. It could be placed adjacent or underneath the generators, thus reducing cable runs to a minimum. Much less floor space was required, and it was a safe and open piece of apparatus, since the tank could be earthed. This type had also a very heavy overload capacity. This type could have a threefold safety factor; for the windings were insulated from the core, the core could be insulated from the tank, and the latter could be mounted on insulators in a similar way to the air-core type. For bus-bar work the ironclad was the cheaper proposition as regarded cost of coils, floor space, and cable runs. For generator work the cost of coils became more nearly equal, but the advantage of floor space and economy in cable rested with the ironclad type. For feeder work, the air-core type was cheaper, but this advantage must be weighed against floor space and the safety of the employé.

Mr. H. A. Ratcliff said the author made out a very strong case for the use of reactances, but nevertheless he thought it was a mistake to regard them as the panacea for all the troubles incidental to the operation of a high-tension electricity supply system. With regard to location, he thought a certain amount of external reactance in the generator circuits was beneficial. For the same total amount of reactance in the circuit, and, therefore, the same current-limiting conditions, the possible mechanical strain on the generator windings would be less when some of the reactance was external. The most suitable location for these reactances was probably between the bus-bar sections, and no doubt ultimately that was where they would mainly be used. He did not consider that they were any advantage in the feeders, and, in fact, they might be a positive disadvantage. He questioned whether such a form of protection was necessary in feeders, and he was inclined to think that the money spent on feeder reactances would be employed to better advantage in putting the very best possible work and materials into the cable joints and the switches at the far ends of the lines. It was a very interesting feature of the concrete-supported coils that should high-frequency surges occur in the circuit, the concrete acted as a high-resistance non-inductive shunt. He would like to know whether the reference to it was anticipation, or whether it had actually been known to occur. His experience of pyro-electric conductors was that a very small current sustained for a very short time produced intense heating, frequently with disruptive effects. He was in agreement with the author as regarded the ironless form of construction. The design and construction of some current transformers was distinctly bad, and they were undoubtedly in many cases the weakest link in a supply system. He agreed with the author that they should be made with the largest possible section of conductor consistent with reliability and accuracy in the duties they had to perform.

Mr. A. G. Ellis said that regarding the protection of large units against deleterious effects of short circuits, the whole question amounted to one of reactance. From the point of view of the transformers, external reactance was really preferable, as it resulted in lower stresses in the transformer under short circuit. The internal reactance of modern large power transformers was as high as 5, 6, or 7 per cent. This, with the inherent reactance of the generators, was usually sufficient to obviate the necessity for external reactances. These were more usually required in cases of extension of existing generating stations to cope with the increasing demands. The author's statement that "there is no gain in the use of iron" in reactances certainly needed qualification. One of the chief gains in the ironclad type was that the magnetic field was confined to the core, and there was no stray field as in the air-core type. It was just in cases where the space available was cramped, as was often the case in extensions, that this consideration was of importance. The apparatus was in itself practically a transformer with one winding. There were certain cases of large reactances where forced air-blast cooling must be adopted for the air-core type. The ventilating fan and motor added another link in the chain of auxiliaries, which reduced the safety factor of operation. The magnetisation of the core at normal current and normal choke was so low that the core loss was negligible.

Mr. W. A. Coates said the ordinary inverse time-limit relay had a curve of operation such that on large overloads, it acted practically instantaneously, and thus selective action was impossible. Some four years ago a relay was patented in this country combining the advantages of the inverse time-limit relay with that of the fixed time-limit relay (Coates and Ferranti, Ltd., No. 29,861, 1913). About the same time in America the Westinghouse Co. produced an instrument having similar characteristics, although the principle of operation was entirely different. It was necessary to allow a sufficient margin of time between adjacent relays to ensure that the contacts on the oil switch nearest to the fault had properly opened. On modern switches this time would be of the nature of 0.15 to 0.2 sec. A similar device working in conjunction with a wattmeter relay movement with very fine settings was employed for use on duplicate feeders, ring mains, and similar systems, so that all ordinary systems of connection could be properly protected with these selective relays. Regarding the rupturing capacity of oil switches, on modern switches length of break was not so much a variable depending on the k.v.a. capacity as one which changed with the normal voltage. It was only within the last few years that the value had been properly appreciated of a large head of oil, and also of an ample air space above the oil.

Mr. E. B. Wedmore, in reply, said the whole subject of the rupturing capacity of oil switches was under consideration by committees dealing with standardisation, and he hoped that their work would result in the issue of information giving more detail. The design of protective devices able to disconnect a partially short-circuited winding presented considerable difficulty. They had a partial solution, due to Messrs. Witcher and Clough, fortunately applicable to very heavy machines where these had two or more windings per phase in parallel. The balance of current between the parallel windings was upset if one winding became partially short-circuited, and they could utilise this to cause disconnection of the machine. He had not suggested that modern switchgear was "absolutely" reliable; his term was "non-speculative." If step-up transformers were associated with individual feeders rather than individual machines, they must be employed at a lower load factor. With large amounts of power this involved serious losses, so that economy compelled them to face the problems arising out of switching at the higher voltage. In saying that "there is no gain in the use of iron," he was not suggesting that there was nothing to put on the credit side of the balance-sheet, but some of the items some of the speakers had endeavoured to put there would be queried by the auditors. He did not follow Mr. Thompson in his argument that there was less fire risk in a design employing large quantities of inflammable material, including oil, than in one constructed throughout of incombustible material and housed in a fireproof chamber. It was not easy to demonstrate that high-frequency disturbances had been absorbed by a reactance with concrete frame in any particular case, but calculation showed that the leakage paths afforded by the concrete were likely to be helpful in dealing with temporary high-frequency phenomena. There was no danger from pyro-electric effects with the proportions employed. He did not follow Mr. Coates's remarks on oil-switch designs. At any voltage the rupturing capacity increased with length of break according to a certain law; within wider limits than might be expected they could vary the relative dimensions of head of oil, length of break, and air buffer without modifying the rupturing capacity materially, and thus it was open to them to choose dimensions which were convenient for manufacture, and for obtaining other desirable features, such as speed of break, and in the arrangement of the parts. As soon, however, as those limits of proper proportion were exceeded the design quickly deteriorated.

TWO ESSENTIAL CONDITIONS FOR BURNING TAR OIL IN DIESEL ENGINES.

By Mr. P. H. SMITH.

(*Abstract of paper read before the* Diesel Engine Users' Association.)

Two main factors, atomisation and turbulence, are essential and cannot be disassociated if really satisfactory running is to be achieved with the use of refractory fuel oils. Atomisation refers to the degree of fineness of the spray at the moment it leaves the flameplate or in the immediate proximity thereof. Turbulence refers to the degree of swirling occurring in the combustion space as the fuel enters the cylinder. It produces a commotion and agitation resulting in a more or less intimate mixing of the fuel and air according as turbulence is more or less vigorous. Efficient atomisation, but without vigorous turbulence, possesses the following disadvantages:—The safe full load rating of the engine must be reduced; the thermal efficiency at large loads is reduced and, therefore, the fuel consumption is high; the operation of the engine is limited to the better qualities of refractory fuel oils. At light loads efficient pulverisation and very little turbulence are desirable, or the mixture may become too dilute to burn.

In the normal Diesel fuel valve, comprising a ring pulveriser, fluted cone and flameplate with rounded orifice, they had a device resulting in deficient pulverisation but ideal turbulence. Atomisation was deficient because the spray issuing from the flameplate was decidedly wet, and this arose through coalescence occurring between the top of the cone and the aperture of the flameplate. Probably at the moment it entered the flutes of the cone the spray was as perfect as that associated with the solid injection system. But on entering the flutes of the cone it lost its confused motion, and settled into regular stream lines, with the result that coalescence commenced on the walls of the flutes and on the sides of the fuel valve. It finally left the rounded orifice of the flameplate to which the coalesced oil adhered, and the resultant spray entering the cylinder was very wet.

Turbulence with the standard fuel valve was excellent. The concave piston head assisted turbulence by ensuring a good whirling action in the space between the piston and the cover, thus intimately mixing the fuel and air. With the normal Diesel fuel valve operating under favourable conditions, a mean effective pressure of 150 lb. per square inch could be obtained with a perfect exhaust, notwithstanding imperfections of atomisation.

At least two known systems of pulverising oil gave what must be an almost perfect spray. In the solid injection system the spray was so finely divided that it scarcely moistened or discoloured an object passing through it. The other he had in mind originated from the whirling spray in its various forms. Yet either applied to Diesel engines, whatever the fuel, was deficient because the other important factor, turbulence, was absent in the solid injection and inadequate in the whirling spray. In the solid injection, the fuel was impelled into the cylinder under a hydraulic pressure of 4,000 to 5,000 lb. per square inch, but as no blast air followed the fuel, it was obvious that turbulence was practically non-existent. Hence such engines were over-rated at 100 lb. m.e.p.

In the whirling spray turbulence was much less pronounced than with the standard Diesel fuel valve. Thus, if an engine of about 12-in. bore was worked long hours at about ¾-load for a week or two, it would be found that there was a well-defined hot zone, about ¾ in. wide, concentric with the piston, and at a mean radius from the centre of about 2½ in. In this zone the metal burned and fused into globules the size of a pin head. If turbulence were vigorous the heat would be dissipated more uniformly throughout the combustion space, and the flame would not be able to concentrate itself locally. Suppose the compressor was becoming rather weak, and with the normal fuel valve would pump up to a maximum of about 850 lb. per square inch only. Then suppose the engine was adjusted with a whirling spray flameplate, it would be found that the compressor could deliver air at a much higher pressure, 1,000 lb. per square inch, for example. This showed that the whirling spray passed a smaller quantity of blast air than the normal fuel valve, and as the whirling spray was diffused whereas the normal jet was concentrated, it followed that turbulence was less with the former than the latter. The form assumed by the whirling spray in its best development was that of a hollow paraboloid. It could be shown that inside the paraboloid very little commotion existed. In the Diesel cylinder the air contained inside this paraboloid was the most valuable for combustion purposes, but because there was so little turbulence at this part, the whirling spray system as they now knew it must remain at a disadvantage where heavy loads were wanted. With the whirling spray an engine might be set to run on tar oil at ⅛ to ¼ load with a blast pressure of 800 lb. per square inch, and the engine would run without missing. If turbulence were as violent as with the ordinary fuel valve, so high a blast pressure would cause this small quantity of fuel to become too dilute to burn. Under the same pressure difference, and tried in open atmosphere, the jet from the normal Diesel fuel valve carried 10 to 15 times further across the room than the jet from the whirling spray. In the latter, increasing the pressure served merely to open the angle formed by the spray. The relatively high fuel consumption at about 100 lb. m.e.p., and the difficulty of clearing the exhaust, pointed to inefficient mixing of the fuel and air in the cylinder, whence, by inference, insufficient turbulence.

With the introduction of tar oil for Diesel engines, the first device they adopted was a flameplate with a sharp-edged orifice in place of the normal flameplate with the rounded aperture. To this the coalesced fuel could not so readily cling, and there was a marked reduction in the wetness of the spray; the safe minimum load on tar oil was reduced about 20 per cent. without sacrificing turbulence or advantages at heavy loads. Tabulating the different systems under discussion in order of merit as regards pulverisation, the comparison being made according to the dryness of the spray, he would place them thus:—Solid injection; whirling spray;

sharp-edged orifice; rounded orifice. And in order of turbulence thus:—Sharp-edged orifice; rounded orifice; whirling spray; solid injection.

From the foregoing analysis it was deduced that the whirling spray system would be greatly improved if a means could be found to increase its turbulence without disturbing its pulverising properties.

The normal Diesel fuel valve being satisfactory for heavy loads and unsatisfactory on light loads, it followed from the above analysis that improvement should be sought in perfecting the method of pulverisation. In the system associated with his firm's name this was achieved by pulverising the fuel closer to the cylinder and introducing violent turbulence at the needle point, and then treating the subsequent coalescence in the flameplate itself in such a manner that liquid particles of fuel were re-converted into spray. The resultant stream passing into the cylinder was remarkably dry and homogeneous, and thus achieved light-load running satisfactorily without sacrificing heavy load advantages.

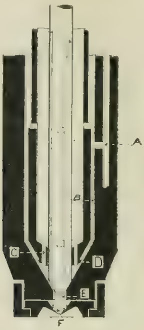

Fig. 1.—Sleeve Pulveriser System for Burning Tar Oils.

The sleeve pulveriser was merely a device for preventing intimate mixing of fuel and blast air until it was desired to effect pulverisation. It supplied a means of delaying pulverisation until the flameplate was nearly reached, whence the mixture was passed at high velocity to the cylinder, its speed rendering the apparatus self-cleaning.

In the diagram, fuel enters at *A* and settles round the outside of the sleeve, where it is subject to maximum blast pressure which, when the needle opens, forces it down the outside of the sleeve and past the restriction *D*, which reduces the oil to film form. The major quantity of blast air impinges on this film with violence as it issues from holes *C*. This reduces the film to spray form, but coalescence commences in passage *E*. The liquid portion so produced is forced into groove *F*, and is there disintegrated again as set forth above.

The hypothesis upon which they designed their sleeve pulveriser was that the choking of the ring type resulted from oxidisation of the fuel, which released free carbon. Conditions for this were ideal in the ring type. In its passage through the rings the oil was beaten into a fine spray, thus presenting an enormous area to the oxidising influence of the blast air at 800 to 900 lb. pressure. The sleeve type of pulveriser overcame this difficulty, and whether the explanation he gave was scientifically correct or not was a matter of small moment to him, as he was no chemist; the hypothesis when applied worked out right, and their sleeve pulverisers, properly designed, did not choke.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

8,727. "Means for operating electromagnetic release gears for use on aircraft." A. W. Judge. May 27th.

8,740. "Preventing rapid exhaustion of primary batteries." T. McLeod. May 27th.

8,749. "Terminal for attachment of magnetic wires to sparking plugs of engines." E. Marazzi. May 27th. (Italy, March 21st, 1917.)

8,755. "Apparatus for direct conversion of energy of motion of a dielectric into electric energy, and conversely for conversion of electric energy into the motion of mass." May 27th.

8,761. "Electro-converter furnaces, and process of treatment for manufacture of steels thereby." P. F. Sarron & J. Simon. May 27th.

8,779. "Variable-circuit electric motor." F. H. Robinson. May 28th.

8,789. "Semi-automatic electric welding device for welding iron or steel studs to plating, &c." A. E. Frankling. May 28th.

8,792. "Automatic speed-limit apparatus for electrical machinery." C. W. Collins. May 28th.

8,793. "Trolley-heads of overhead electric vehicles." C. W. Collins. May 28th.

8,811. "Overload switches." P. G. van Wijk. May 28th. (Holland, March 7th.)

8,819. "Alternating-current protective devices." G. Kapp. May 28th.

8,846. "Sparking plugs for internal-combustion engines." J. E. Barrows. May 29th.

8,867. "Electrically-heated perforator." A. B. Campbell. May 29th.

8,870. "Electric transformers." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 29th.

8,881. "Ignition devices." F. W. Vickery. May 29th.

8,883. "Magneto-electric machines." S. Evershed & Evershed and Vignoles. May 29th.

8,884. "Electromagnetic devices." G. Plaisant. May 29th.

8,933. "Electric milk steriliser." D. Suchostawer. May 30th.

8,936. "Incandescent electric lamps." Osram-Robertson Lamp Works and T. J. Sack. May 30th.

8,941. "Dynamo-electric machinery." J. W. Burleigh. May 30th.

8,953. "Self-regulating continuous-current dynamo." A. H. Midgley and C. A. Vandervell. May 30th.

8,978. "Electric fuse carriers." A. C. Checketts & A. C. Robinson. May 31st.

8,998. "Regulating arrangements for electric circuits, chiefly for controlling dynamo-electric machinery." J. C. Watson. May 31st.

9,003. "Magneto-electric machines." British Thomson-Houston Co. and A. P. Young. May 31st.

9,016. "Electric spark-gaps." M. L. Magneto Syndicate & E. A. Watson. May 31st.

9,018. "System of distributing electric energy." C. H. Wordingham. May 31st.

9,021. "Windings in electrical apparatus." Brush Electrical Engineering Co. & P. W. Scholfield. May 31st.

9,023. "Electric torches." Efandem Co. & F. J. J. Gibbons. May 31st.

9,025. "Primary batteries and manufacture thereof." G. Wallace. May 31st.

9,028. "Treatment of refractory metals." Edison Swan Electric Co. May 31st.

9,056. "Electrical installations." L. Joubert. June 1st. (France, June 4th, 1917.)

9,068. "Detector for wireless telegraphy." M. Compare & Comparri Wireless Control Syndicate. June 1st.

9,074. "Means for controlling electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) June 1st.

9,075. "Alternating-current dynamo-electric machines." British Thomson-Houston Co., H. W. Taylor & J. Whitcher. June 1st.

9,082. "Interlocking plug switches." H. Stokes. June 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

117. Electrolytic Apparatus for the Generation of Oxygen and Hydrogen. I. H. Levin. June 3rd, 1916. (107,366.)

5,009. Controlling the Current in Connection with Electro-magnetic Gear Boxes of Automobiles. Wolseley Motors, Ltd., & T. Wardell. April 10th, 1917. (115,458.)

6,508. High-frequency Alternating-current Dynamos. Crompton & Co. and N. Pensabene. May 8th, 1917. (155,475.)

6,556. Fusible Electric Cut-outs. British Thomson-Houston Co. & E. B. Wedmore. May 8th, 1917. (115,478.)

6,558. Sound Boxes for Sound-producing Machines. H. T. Logan and Universal Music Co May 8th, 1917. (115,481.)

6,584. Electromagnetically-operated Brake Mechanism for Cranes or the like. Ransomes & Rapier and R. S. Lewis. May 9th, 1917. (115,485.)

7,354. Self-regulating Dynamo-electric Machines. W. Holt & B. Brooks. May 22nd, 1917. (115,509.)

7,718. Rectifying Interrupters for X-ray Purposes. A. E. Dean. May 30th, 1917. (115,518.)

8,198. Motor-car Lights and Lamps. E. R. Rysman. June 8th, 1917. (115,519.)

9,092. Control Mechanism for the Electrical Fittings of Motor Vehicles. R. W. Maudslay & Standard Motor Co. June 25th, 1917. (115,532.)

11,079. Secondary Electric Batteries or Accumulators. Chloride Electrical Storage Co. & H. Dean. August 1st, 1917. (115,551.)

12,414. Fittings for Electric Lamp Shades, Reflectors, and the like. F. A. Reynolds & A. Reynolds. August 29th, 1917. (115,561.)

12,478. Control Systems for Electric Motors. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.) August 30th, 1917. (115,563.)

12,480. Phase-balancers or Phase-converters for Polyphase Distributing Systems. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.) August 30th, 1917. (115,564.)

13,286. Electrical System for Electric Furnaces. T. H. Watson & Co., H. A. Greaves & H. Etchells. September 17th, 1917. (115,570.)

16,849. Means for Cooling the Collector Rings of Dynamo-electric Machines. Svenska Turbinfabriks Aktiebolaget Ljungström. August 6th, 1917. (115,378.)

16,916. Method of Assembling the Armature Plates in Magnetos having a Fixed Armature. E. C. R. Marks (Soc. Anon. des Etablissements L. Bleriot). December 18th, 1916. (Divided application on 18,144/16.) (115,379.)

16,917. Method of Fixing the Armature in Magnetos having a Fixed Armature. E. C. R. Marks (Soc. Anon. des Etablissements L. Bleriot). December 18th, 1916. (Divided application on 18,144/16.) (115,380.)

16,975. Electric-ignition Distributors for Internal-combustion Engines. H. W. F. Ireland. November 18th, 1917. (114,990.)

17,335. Electrical Signalling Systems. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. May 8th, 1917. (Divided application on 6,542/17.) (115,590.)

17,769. Electric Flashlamps. M. Goodfellow & British Ever-Ready Co. November 30th, 1917. (115,381.)

18,070. Electric Signalling Systems. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. June 12th, 1917. (Divided application on 8,416/17.) (115,594.)

18,216. Alternating-current Relays. Waygood-Otis, Ltd. (Otis Elevator Co., U.S.A.) December 8th, 1917. (115,595.)

18,502. Telephone Systems. Automatic Telephone Manufacturing Co. January 8th, 1917. (112,774.)

1918.

831. Street and Station Indicators. W. Clark (F. B. Robinson). January 14th, 1918. (115,394.)

1,539. Electric Attachment Plugs. W. Hunt (Bryant Electric Co., U.S.A.) January 26th, 1918. (115,008.)

5,230. Electric Couplings. H. de la Valette. March 28th, 1918. (Addition to 105,227.) (114,429.)

3,408. Electric Light Fittings. E. R. Hough & L. Harrison. February 26th, 1918. (Addition to 2,928/15.) (115,400.)

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ELECTRICAL CONVENTIONS.

WE do not remember any event held in this country during the last four years that could be termed a War Convention of Electrical Men. Of course, there have been innumerable gatherings at which electrical engineers have in groups discussed certain sectional aspects of war problems and activities, or there have been larger meetings in which, more or less casually, general electrical considerations of the times have received attention. As a matter of fact, electrical engineers and commercial men have been fully engaged upon their own piece of work, or, shall we add, seeking an opportunity to get into a position where they can efficiently exercise their specialised training and experience, so that the opportunities for general war conventions have not been numerous. Yet it might not have been a bad idea, had it been possible, from time to time to carry it out without running the risk of offending Dora or conveying information to the enemy, if we could have met from time to time purely to discuss whether our resources of electrical men and intelligence power were being as fully availed of as they could be for the purposes of the war. We do not pretend to believe that such general and efficient use has been made of these resources during the changing course of the war as could be done now by effective organisation and Governmental encouragement if we were just about to begin hostilities. We shall know better how to do things another time!—may we never have to put into practice all the lessons taught us by the war for which we were so unprepared—may there be no "other time," but if there is, well, we shall know better how to proceed and how to be as ready as Herr Rathenau and his august associates, or more so.

We have just been celebrating the first anniversary of the landing of American Forces in France, and as we read the electrical journals that reach us from the States we find ample evidence of our great Ally being "all in" and "with both feet"—as well as, may we add, with both wings—it is so technically as well as in respect of fighting forces. Yet though the whirl of factory life and the tramp of men to camp, flight in the air, and continuous passage of shipping of all kinds through the trackless main, tell of one vast organisation designing and determined to decide the one World issue, electrical men are holding war conventions. At one such held in California from May 6th to 11th, attended by 400 delegates, the American *Electrical Review* says:—"The spirit of patriotic service pervaded the atmosphere . . . and ways and means of marshalling the electrical forces represented, in co-operation with the Government, to prosecute and win the war, were given a dominant place in the addresses, papers, and discussions." The Convention was a joint one of the electrical organisations of the Pacific Coast; the National Electric Light Association, the Electrical Supply Jobbers' Association, and the Californian State

Association of Electrical Contractors and Dealers took part. Our contemporary describes the event as one of the most important of the meetings of U.S. electrical interests held this year, and the foremost result was the "crystallisation of thought and action for meeting war problems." The president struck the right note by a patriotic appeal for the co-operation in effort and singleness of purpose of the electrical industry in war service, which reminds us that though that blessed word "co-operation" has been preached here from the housetops for a long time past, it has been practised sectionally rather than by the industry and profession as a whole, and that at times it has been less impressive than it might have been had co-operation between the Government and the industry been more complete. We have even heard it complained by some who call themselves trade journalists that though they have pressed their suit with fervour the heart of the Government has been as adamant. It may not be that we have so experienced it, for we believe, as we have said before, there are those in the Government who know where to find out what they want to know without appealing to all and sundry. We have been assured, have we not, that it takes two to make a quarrel. We know from experience that it takes more than one to secure co-operation that is worth the having, and, great as may be our ambition in respect to co-operation in the interests of the nation, after all, each must be allowed to decide whether or not his proposed bed-fellow is a desirable person. In the States those in high authority hold modern views in respect to such publicity, and they started it early by securing the co-operation of the right experts connected with the Press. Here, though editors have been taken into confidence, perhaps publicity service has not been one of our best achievements. Perhaps it is not altogether a matter of surprise, for it is not always above suspicion, and may make blunders.

The Californian Convention found little difficulty in following the co-operative lead of the president when he appealed for the co-operation of the electrical industry in war service. Those who followed dealt with such matters as water-power development, fuel conservation, and "a sane policy of informing the public," words which we must accept without quite appreciating their American significance. In the Commercial Section a speaker urged the "acquirement of the national vision instead of the sectional-view point." In the Women's War Service Section (where have we its electrical counterpart here?) the subjects under attention included the need of an open-minded policy in working out the problem of Americanising foreign-born residents. Exactly what this means is not quite clear to us, who, after war-time experiences, are not over anxious to facilitate the naturalisation of aliens within these islands at present, but it is somehow related to the "problem and opportunities arising from the greater employment of women in electrical industry"—a problem concerning which some of our own Ministry of Munitions authorities can teach our Allies much that doubtless they want to know. The Convention held a special War Service Session of the Engineering Section, where the work on conservation and war measures had been carried on by sub-committees in co-operation with State and Federal officials. The topics here considered were:—Possible water-power developments, and their urgent need; the utilisation of Californian power resources, and the quite homely English problem of the joint operation of power companies; the need for securing necessary financial aid for quickly developing additional hydro-electric energy; the interconnection of tranmission systems; how to meet the impending fuel-oil shortage; the urgency of railroad electrification to save fuel oil, of which the railways were the largest consumers; the use of powdered coal and saw-mill refuse; a hundred minor ways of economising in fuel consumption so as to meet the fuel situation of the next year or two. One day's session considered operating problems in the production and transmission of power, with special reference to economical practice, and boiler-room economics was the subject of practical suggestions relating to bonuses for stokers and the larger use of poor-grade coal in powdered form. The mere mention of these headings shows how vast a ground is covered by technical electrical problems in which these 400 war-time representatives were interested. In addition to all their joint gatherings, each of the three organisations held their own separate meetings to consider matters of particular concern to their own branches of the industry.

We hope that the time is not far distant when we shall have more electrical co-operative associated conventional meetings in this country than we have had in the past. The Institution of Electrical Engineers is, or ought to be, at the head of us all, and no doubt some worthy convention effort under its auspices may be possible in course of time. It could not be conducive to other than good. It might remove some of the Sectional suspicions and some of the asperities that exist even in these days. When this issue appears in print, the Congress of the Incorporated Municipal Electrical Association will be in progress at Manchester. It meets to consider one great question—electric power supply—we think we might say our *greatest* question, for in it practically all other interests of the electrical industry are interlinked. If ever there was one matter in which there was a need for entire co-operation, surely it is here.

Report on Electrical Trades After the War.

At last our patience is rewarded, and the complete report of the Electrical Trades Committee, at which we have been permitted to make a few bites from time to time, has now appeared. In view of its importance, we propose to publish it pretty well in full, but the demands upon our space this week prevent us from giving more than the Committee's observations on the national importance of the electrical industry and the recommendations made as a result of the investigation. We shall deal with the several sections in following issues, as it is essential that the whole matter be placed on permanent record in our pages. We trust and believe that the report will have a substantial influence on the framing of national policy respecting electrical industry and trade. The few preliminary "bites" to which we refer above have been very much to our taste, and now that we have the whole dish before us we are gratified to find that they were but representative samples of the most excellent whole. Reform in respect of legislation comes first and foremost in the recommendations, and we have assurance from prominent quarters that such will be introduced before very long. To the proposal that enemy electrical goods should not be imported for three years from the conclusion of Peace, save in exceptional circumstances after 12 months, and then under licence, there will be few objectors to-day, while we believe that the revelations of the past four years will bring large support to the recommendation that such import duties shall be imposed as will effectively protect the industry. The prevention of enemy dumping of electrical goods will find general favour, as will also the proposals respecting the prevention of enemy control in electrical and allied manufacturing industries and the limiting of enemy ownership of capital in such businesses. To deal satisfactorily with the products of enemy-controlled works in neutral countries will require a very searching and skilful Intelligence Department. It is one of the most difficult, and yet one of the most essential, services that we shall have to provide as part of the machinery for defeating "penetrative" designs. The other proposals are that the British Government and public authorities should show a real preference for British-made electrical manufactures, and use standard types and patterns as far as possible: that the industry should recognise the advantages of combination, and should receive official encouragement to that end; that any transport arrangements shall be such as to assist rather than to handicap industry; that there should be industrial harmony; that better banking facilities should be provided to assist industry; and that Empire resources should be preserved from alien control. Those who have made a prolonged study of the electrical industry and its manifold problems will recognise that the Committee's main conclusions relate to subjects which have cropped up periodically during the last 20 years. We should not allow the occasion to pass without paying a tribute to the patience and diligence with which the members of the Committee carried out their very difficult duties. We are quite sure that if they had had a deciding voice in the matter, the publication of the complete report would not have been delayed for more than a year after they had put the finishing touches to it.

Unity is Strength.

FROM the reports of meetings which appear elsewhere in our pages, it will be seen that the issue between the established Electrical Power Engineers' Association and the prospective Association of British Electrical Engineers (Electricity Supply Section), as we anticipated, has suddenly come to a head. The "mass meeting" convened by the Institution of Electrical Engineers at Leeds was of a somewhat stormy character; by a large majority an amendment hostile to the proposal before the meeting was adopted, but the chairman refused to proceed to the election of delegates to place the views of the meeting before the mass meeting that is to be held in London, although this was one of the avowed objects for which the meeting was convened. We must confess our inability to follow the reasoning which justified this course; its obvious effect was that the Leeds engineers must either support the official proposal or be deprived of any voice in the proceedings in London, an arbitrary condition which is hardly compatible with the principles of democracy. While we regret the decision arrived at by the Leeds meeting, we cannot deny that there was some justification for it; as we have previously pointed out, the E.P.E.A. has a large membership, and covers the identical ground that is to be tilled by the A.B.E.E., yet the latter apparently has hardly recognised the existence of the former.

Once more we express the earnest hope that these two important movements will be welded together into one strong body, for disunion spells disaster. We are confident that the feat can be accomplished, for the aims of the two Associations are practically identical, and it is perfectly certain that an Association assured of the official support of the Institution will exert a far greater influence than a wholly independent organisation. Fortunately, Mr. Wordingham has come to the rescue, and by the invitation which he has issued to members of the E.P.E.A. to confer with the Council of the Institution, he has opened the way to the attainment of a cordial understanding between the parties, which will, we hope, afford a speedy solution of the present very difficult situation.

British Manufacturing in Australia?

IN our opinion British manufacturers should be watching very closely the industrial developments that are taking place in Australia. The war has thrown our kinsmen out there upon their own resources. Nowhere is there a stronger determination to dispense with enemy manufactures in the future; but apart altogether from such a consideration, there are several reasons which have directed serious attention to the question of establishing industries in Australia. It is, of course, recognised that the limited population of the Commonwealth can never create such a demand for certain lines of engineering manufactures as to make competitive production a practicable proposal; but there are many of the smaller lines which it is thought can be produced there in sufficient number and at such a price as to justify the putting down of a factory. In certain articles this has been done in recent years, and the prospect of difficulties standing in the way of exportation from this country for some time to come is lending strength to the movement at this moment. One of the factors that is weighing with those interested in the matter is the importance of starting new industries for returning soldiers of the Commonwealth. Telephone instruments are a class of manufacture which have come under discussion and inquiry in this connection. Trained observers of the industrial situation in Australia are urging British manufacturers to study the situation in relation to their own businesses, so that they may be able to decide whether they should start branch factories there. No doubt manufacturers of small, or comparatively small, electrical lines, will find it politic to consider the subject.

Coal Economies in Germany.

THE electrical representative of the German Coal Controller discusses (*Elektrotechnische Zeitschrift*, February 21st) methods of reduction in the consumption of electricity, and the consequent saving of coal. A great increase in the consumption of electricity for power purposes has taken place in Germany during the past two or three years. As the output of coal cannot be increased in proportion, in view of labour shortage, the coal supply must be considered as strictly limited. The number of units generated by German stations was respectively 1·5, 5·1, and 10 thousand millions in the years 1909, 1913, and 1917, and the total has increased by more than six times during a period of eight years. While the coal consumption represents but a small proportion of the total consumption of the country, it is still possible to economise considerably in electric generating stations. The proportion of current for lighting to the total output of current has decreased enormously during 25 years, this ratio being 0·8, 0·41, and 0·10 in 1895, 1905, and 1915. It is now only 0·08, which is due to the increase of power requirements. Thus it may be possible to economise coal without affecting power output as distinct from lighting output. A considerable quantity of power is consumed by agricultural operations, and one means of saving is to cut off the supply during certain periods of the night, thus avoiding no-load losses. As regards tramways, certain quantities of energy may be saved by discontinuing suburban services in the large towns and increasing the distances between stopping places.

With reference to current for lighting, greater saving is possible than might at first be anticipated in view of the small proportion of the lighting load to the total load. This is due to the peak loads that are obtained, and any means of smoothing out the peaks will considerably influence coal consumption. Such methods include alterations of working hours, theatre hours, general restriction of lighting, substitution of metal-filament for carbon-filament lamps, &c. The peak could also be reduced by stopping motors at certain hours, restricting the use of lifts at certain periods of the year and times of the day, and by other means. The desired object would also tend to be obtained by curtailing the lighting and heating of tramcars, limiting services, &c.

THE BRITISH MAGNETO INDUSTRY.

The invention and evolution of the magneto has been one of the most important developments of the petrol motor ; so much so, that the motor trade is entirely dependent on a regular supply of good magnetos. Yet, prior to the war, this country had not seriously attempted their manufacture. Thanks to the assistance of their Government, the German magneto manufacturers had built up powerful selling organisations in this country, and these, backed by large resources, had been able to prevent the establishment of a British magneto industry on any scale worth recording.

Consequently, the outbreak of war produced a very critical situation. German magnetos were out of the question, and the U.S.A.—the only source of supply—was not in a position to meet the demand either in sufficient quantity or requisite quality. In particular, it could not supply many special types, some of very intricate nature, required by the rapidly expanding flying services. Little doubt is entertained that in subsidising and supporting their magneto manufacturers the German Government recognised the extreme importance of this key industry, and hoped seriously to disorganise our motor transport and air services. Their policy was so far successful that during the early days of the conflict there was a serious shortage of magnetos, and an entire lack of the plant and organisation required for their manufacture. It was, therefore, of vital importance that the manufacture of magnetos should be undertaken in this country, and that no time should be lost in establishing the industry.

Several firms speedily realised this fact, and much of the success which has been attained may be attributed to the formation of the British Ignition Apparatus Association and the opportunity it has afforded for co-operation and interchange of information and views among its members.

There was at the outbreak of war only one British firm making magnetos, and its output was less than 100 machines per week. There was nothing for it but to create a new industry. This was done—in time. But the conditions at the start afforded little prospect of success. To begin with, there was the question of getting the right grade of steel for the magnets—a far more important matter than is apparent. That difficulty was early overcome by the steel makers of Sheffield, and the British magneto is to-day, from that point of view, better than the German. Then there was the "stabilit" used for insulation. That was a much more difficult problem. But this again has been successfully dealt with. In the early days almost every "moulded" part of the magneto had to be carved out of solid vulcanite, but now there is no lack of excellent moulding material. The enamelled wire presented another difficulty ; there is about three-quarters of a mile of very fine enamelled wire on the armature of the magneto, and steps had to be taken to secure a supply of this commodity. Finally it was necessary to provide suitable machinery, and to train great numbers of work-people in the art of magneto manufacture. All the difficulties—technical, commercial, and administrative—have now been completely overcome. Ceaseless work in laboratory and workshop has improved the first "best" out of knowledge ; new designs have been originated ; new methods have been introduced ; and now we can claim that there is no magneto that is better than the British for performance and efficiency.

As one of the results of the co-operation alluded to above, all users of British magnetos will enjoy the many advantages which arise from standardisation in production. The complete magnetos are to be interchangeable, not only with one another, but with the best-known pre-war types. Further, many of the essential parts are to be standardised and made interchangeable. Screws, for instance, will be used of standard dimensions ; and the different sizes of brushes are being standardised and reduced in number to one-tenth. This means, first, that spare parts will be much cheaper ; secondly, that they will be easily and quickly procurable. The advantages of the co-operation are increased by the fact that certain firms are concentrating on particular types.

Between them the members of the B.I.A. Association had up to the end of last year completed over three hundred thousand magnetos, which are being used wherever the fighting services are at work.

It has been stated on good authority that the imports of German magnetos into this country in pre-war days amounted to 200,000 per annum. The B.I.A. Association is now turning out as many as 5,000 machines a week, and it is hoped that this output will be greatly increased in the near future.

Last week we were privileged to make a tour of inspection of the works manufacturing British magnetos. Great interest was afforded by the visit to the Marks & Clerk Laboratory, where scientific research on electric ignition problems has been carried out. Special attention has been given to the study of magnetos and induction coils, and to the ignition phenomena of internal-combustion engines.

The firm of Thomson-Bennett, Ltd., was formed in 1907 to undertake the manufacture of ignition fittings, and for the first few years was mainly engaged upon the production of coil ignition apparatus. The production, in a small way, of magnetos, was commenced in 1909, and was developed outside the motor trade proper, the majority of the machines bring supplied for agricultural, stationary, and marine engines. Thus at the outbreak of war this was the only firm actually manufacturing magnetos in the whole country. The output was small, the weekly average being only about 25. In the autumn of 1914, arrangements were entered into with Joseph Lucas, Ltd., and the present company, Thomson-Bennett Magnetos, Ltd., was the outcome. The present works were specially erected and equipped, and the staff moved into their new home a little over 12 months ago. Since the reorganisation very nearly 100,000 magnetos have been produced for all classes of work. The weekly output of this firm is already very large, and it is hoped practically to double it by the end of the year.

It has been necessary so far to continue the manufacture of a fairly large number of types, as a number of these could not be obtained elsewhere. In future, attention will be concentrated on a smaller programme to ensure quantity production on the most economical basis possible.

The branch of the organisation of the British Thomson-Houston Co., Ltd., which is now entirely used as a magneto factory, undertook before the war the manufacture of electrical meters and instruments of precision. It was, therefore, in a unique position to undertake the manufacture of magnetos. In the early days, before Government contracts were placed with the company for magnetos, they started to build cycle and car magnetos, and many thousands were delivered. Special attention was given to a particular type, and all the energies of the organisation were absorbed by the task of establishing the manufacture of high-speed magnetos on a thoroughly reliable basis. Several new designs were developed and tested, and, as a result of the experimental and research work that has been carried out, the company is now building a four-spark polar induction magneto that is a vast improvement upon anything manufactured by the Bosch company, this having been developed on quite different lines to the type of magneto familiar to motorists.

So rapidly did the small business of Messrs. Morris and Lister, Ltd., progress that, early in 1915, the works, staff, plant—everything, in fact, became utterly inadequate for the contracts on hand. A separate company was formed, under the name of the M.-L. Magneto Syndicate, Ltd., and large works were found which were suitable for its requirements. "Seeing is believing," and the works prove in no uncertain manner the firm's progress. They form, indeed, a powerful testimony to the energetic manner in which a difficult situation has been faced and conquered.

The firm of Messrs. North & Sons, Ltd., had the advantage of experience in the manufacture of speedometers, which have many features in common with magnetos, so that it was not a difficult matter for it to take up the new line. Its works have been specially designed for the purpose, and employ over 1,000 hands ; moreover, they are entirely self-contained, producing all their own castings, forgings, and insulating materials, and possess an admirable equipment of automatic and semi-automatic machine tools, which enable them to turn out accurately finished parts at a minimum cost.

The staff is highly trained, and provided with the most up-to-date appliances, which enable interchangeable parts of the highest quality to be produced. Numerous ingenious devices have been adopted to facilitate rapid production, combined with certainty in attaining the desired result, and some remarkable examples of hot-pressed work in brass form an interesting feature of the magneto work, while the employment of the stroboscopic method for the quick and accurate calibration of speedometers deserves special mention.

The members of the B.I.A. Association having manufactured in large quantities magnetos of every description, which have given thoroughly reliable results in practice, we have no hesitation in saying that when hostilities cease they will be in a position to place new designs of magnetos on the market which will be better in all respects than those manufactured in Germany. Further, they will be produced in such ample numbers that the demands of the motor and allied industries after the war will be fully met, as regards both quantity and quality.

THE ELECTRICAL TRADES AFTER THE WAR.

Report of the Departmental Committee.

We begin below a reprint of the report (Cd. 9072, 2d. net.) of the Departmental Committee appointed by the Board of Trade to consider the position of the electrical trades after the war. The report is dated April 18th, 1917, and is signed by:—Sir C. A. Parsons (chairman), Mr. J. Annan Bryce, Sir T. O. Callender, Mr. James Devonshire, Mr. B. M. Drake, and Sir John Snell. The Committee records its appreciation of the valuable services rendered by the secretary, Mr. J. F. Ronca. As it is impossible to give the entire report in a single issue, we turn to the end of the document first, in order to give the Committee's summary of recommendations. These are as follows:—

1. A thorough reform of the legislation and conditions under which the generation and distribution of electricity are promoted and administered in this country which will involve modifications in the relevant Acts and Regulations; and a like reform of the legislation and conditions affecting the promotion, construction, and operation of tramways and light railways.

2. The prohibition of import of enemy goods for a period of three years after the conclusion of Peace, subject to the importation under licence in special circumstances after the expiration of the first 12 months.

3. The imposition of import duties sufficiently high to protect effectively the electrical industry.

4. The prevention of the sale in the United Kingdom of any imported electrical goods at prices lower than those current in the country of origin.

5. The recognition of the advantage of combination among manufacturers and official co-operation with such action.

6. The prevention of any concern engaged in the electrical or allied manufacturing industries, if controlled directly or indirectly by enemy capital, from continuing to trade within the Empire, unless it be specially authorised and its constitution made public, and the passing of legislation requiring that not more than 25 per centum of the capital in any other electrical or allied undertakings shall be held either directly or indirectly by enemy subscribers or their agents.

7. The treatment as enemy products of all goods produced in foreign countries by concerns controlled by enemy capital or under enemy direction.

8. The exclusive acceptance of British tenders by State Departments, public bodies, and companies supplying electrical energy under statutory powers.

9. The adoption by Government Departments and public authorities so far as is practicable, of standard types and patterns of plant and apparatus.

10. The prohibition of transport discriminations operating to the detriment of British manufacturers, and the provision of improved transport and cargo handling facilities.

11. The promotion of a better understanding between employers and employed, and the provision of better housing and working conditions.

12. The provision of extended banking facilities, preferably by the establishment of industrial banks, to enable British manufacturers to secure and finance contracts and engineering enterprises.

13. The recognition of the permanent and ever-increasing importance to the Empire of the natural sources of power for the generation of electricity in the British Dominions, and the introduction of safeguards by legislation or otherwise to prevent these national assets from passing into alien hands or under alien control.

Certain further recommendations will be made in a supplementary report dealing, *inter alia*, with education, research, the decimal system, and the consular service.

The Committee was appointed to consider the position of the electrical trades after the war, with especial relation to international competition, and to report what measures, if any, are necessary or desirable, in order to safeguard that position. Evidence was given by the I.E.E., the I.M.E.A., the Association of Electric Power Companies, the B.E.A.M.A., the Cable-Makers' Association, the Tramways and Light Railways Association, eminent consulting engineers, manufacturers of machinery, cables, and other electrical appliances, directors and engineers of important electric supply undertakings, by bankers, and many others.

The national importance of the electrical industry is first reviewed, and thereafter the report is divided into several sections:—

1. Electricity generation and transmission in the United Kingdom.
2. Electric traction in the United Kingdom.
3. Manufacturing.
4. Financial interdependence between manufacture and finance.
5. Imperial control of sources of electrical energy.
6. Summary of Recommendations (reprinted above).

There are two appendixes; one deals with measures against enemy trade to be adopted on the conclusion of Peace (this is dated October 11th, 1916), and one on banking and finance (dated July 20th, 1916).

The reference to the National importance of the electrial industry reads as follows:—

3. The Committee is of opinion that it is impossible to give proper consideration to the future of the electrical trades without studying the position of the electrical industry as a whole. The national importance of this industry has never been realised either by Government or by the general public, and as a consequence both the industry and the country have suffered from legislative errors.

4. Through the efforts of Faraday, Wheatstone, Kelvin, Swan, Hopkinson, and many others, Great Britain was, and should have continued, first in electrical enterprise. The nation's pre-eminence in all branches of engineering provided a foundation upon which the new and closely allied electrical industry might have been naturally and quickly built up. Mines and factories were so situated as to gain rapid advantage from the application of electrical science, and railways, especially the urban and suburban lines, were, owing to density of population, ideally suited to electrification. In order, however, to bring electrical energy into practical use it was necessary to employ cables, either underground or overhead, the installation of which involved interference with streets, roads, and private lands. Manufacturers of electrical plant have been held back while Parliament and local authorities debated how the distribution and use of electricity might be prevented from infringing conventional conceptions of public privileges and vested interests. Hence the progress of the industry has throughout been hampered by political considerations. While America, Germany, and other countries were eagerly seizing the benefits of electricity, our authorities were busied with the erection of obstacles to its development. Thus for years this country stood still, leaving the field open for foreign manufacturers to gain, both in their own and other markets, a hold which they have never lost. Abroad there were strong encouragements, in Great Britain irksome restrictions, and the evil effects on the British electrical industry justly entitle it now to special remedial measures, which can be secured only by legislation. Such legislation should be passed without delay.

5. The early history of motor traction on highways is an analogous instance of legislation which proved disastrous. Mechanically-propelled vehicles were successfully adopted in this country early in the 19th century, but prejudice and the horse interest succeeded in inducing Parliament to pass restrictive legislation which, by limiting speed to four miles an hour, practically destroyed the industry. As a result the manufacture of motor cars in Great Britain was for many years, and in some respects still is, behind that of other countries.

6. The prosperity of our industries depends largely on cheap energy for driving machinery, and even a fractional reduction in price is of importance in determining the ability of manufacturers to compete in the world's markets. The appli-

cation of electricity to agricultural purposes is also claiming attention, and will, without doubt, extend.

7. The scientific replanning of our distribution of energy would effect a saving of no less than 50 million tons of coal per annum. Till lately coal has been so cheap that its conservation has been neglected, but it must be strictly economised in the future if the maximum return from this irreplaceable national asset is to be realised. This replanning would also reduce the cost of power for manufacturing, for the lighting of streets and houses, for the propulsion of railway, tramway, and road vehicles, and at the same time greatly promote social and domestic convenience as well as general improvement in public health.

8. Witnesses of high authority estimate the loss incurred by the nation through failure to take full advantage of electrical progress at not less than £100,000,000 a year, a loss preventable by concentrating generation under improved administration.

9. The density of her industrial population over wide areas, the length of her seaboard, and its proximity to manufacturing centres, the richness of her coal supplies, the advantage furnished by her climate to textile manufactures, the effect on her markets of the close connection with the Overseas Dominions—all combine to make Great Britain the most favourably situated country in the world to derive the fullest benefit from the use of electrical power.

10. The value to this country of the electrical manufacturing trade has not been sufficiently realised. The volume of this trade already amounts to 22½ millions sterling a year. Considerable as these figures are, they represent only a fraction of the trade which can be obtained if the blunders of the past be rectified. A world trade exists, and Great Britain must have her proper share. In no branch of engineering will technical proficiency and mechanical skill find better recompense than in electrical manufacturing, and none deserves more consideration by the State.

11. It is not too much to say that the war has demonstrated the safety of the Empire to be dependent on the employment of electricity. The output of munitions in the great industrial areas could not possibly have attained anything like its present scale had not an enormous aggregate horse-power of electrical energy been available for the supply of power and light. The emergency has proved the electrical industry to be a "*key industry.*"

(*To be continued.*)

THE ASSOCIATION OF BRITISH ELECTRICAL ENGINEERS (ELECTRICITY SUPPLY SECTION).

A MEETING under the auspices of the WESTERN LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS was held at Bristol, on Friday last, in connection with the formation of a branch of the above Society.

The President-Elect of the Western Local Section, Mr. H. I. ROGERS, presided over a representative audience. In introducing Mr. H. Faraday Proctor, he remarked on the advantages of unity, and expressed the hope that all the various societies at present being formed would be absorbed in one central body.

Mr. H. FARADAY PROCTOR explained the objects of the meeting, and said the proposed association was intended to embrace all existing associations in order that there might be one association only. The Council of the I.E.E. had decided that the new association could be registered as a trade union if the members thought fit. The reason why the proposed association was being formed under the auspices of the Institution was solely the fact that the conference of the various associations held on February 7th felt that the Institution, as premier body, should take the initial steps. It was most important that a large numerical representation should be secured to the Association in order that its weight might be felt. With regard to linking-up with other similar associations, he read a resolution of the National Executive of the Electrical Power Engineers' Association held in Birmingham on June 1st:—"That this National Executive Council of the E.P.E.A. desire the co-operation and final linking-up of all technical engineers engaged in the electricity industry." That was just what they wanted. The desirability of combination was emphasised in the Whitley Reports, which advocated the formation of National Councils for every industry, and in addition to the National Councils there would be local district councils, also works committees. The reports specified that these councils should only be formed in connection with industries that were properly organised. The workmen had their unions, the employers had their federations, the municipalities had the Incorporated Municipal Electrical Association, and the companies likewise had their associations. Station engineers were not organised; it was very necessary therefore that a representative association of such gentlemen should be formed at once. At Cardiff on the previous day the point was raised whether chief engineers should belong to this association. He thought the chief engineers ought to be there to assist their respective staffs. It would be advantageous for every engineer to be in it. It would not do for master and man to be in the same association, which would be the case if the Electrical Trades Union secured any of them as its members. Another point raised was as to the necessity of this new association, as there were plenty already in existence. There were several of them, but there was no one representing the whole, and he thought it was very necessary that this association should be formed, and final amalgamation effected. It was decided at Cardiff that there was no objection to heads of departments and chief engineers being included; a resolution was passed in favour of forming the association, and a delegate was appointed to attend the mass meeting in London.

The CHAIRMAN read the names of a number of gentlemen who, though unable to be present at the meeting, expressed their hearty support of the movement, and said there was no possible doubt that both sides of every industry would have to form themselves into associations in order to get their proper positions on the National Councils that were about to be set up for each industry. It was most essential that one very strong body should be formed, and it was a very good thing that the I.E.E. as a senior body in the electrical industry should have promoted the organisation of the new association. In a recent issue of the *Board of Trade Journal* he noticed that Germany was inaugurating, as one of her post-war projects, Chambers of Labour, and it was significant that a separate chamber was to be organised for salaried officials.

Mr. J. W. BACHE (Cheltenham) asked whether this association would be an association of associations, or an amalgamation of others with similar objects. He assumed that the particular directions in which the thought of the society would be directed would be terms of engagement, security of tenure, adequate salaries, and possible superannuation. The status of the profession would be raised were it a *sine qua non* that important appointments to municipal or company posts should be given to members of the I.E.E.

A discussion followed, and Mr. H. FARADAY PROCTOR said he thought they were taking the wisest course by allowing this association to be formed under the auspices of the I.E.E. It would be well if some of the other societies were to approach the larger institutions and get them to make a move. If they got the professional institution to give them their blessing and backing, who was there to say anything against them? He suggested that this association, if formed, should be a sub-section of a larger section representing all electrical engineers, and that the electrical engineers should be a section of a larger body embracing all engineers, the executive being a council, grand council, and, if they chose, a super-grand council. Until this organisation was effected, the connecting link was almost missing. Eligibility for membership was the only matter on which he experienced difficulty in speaking. Of course, the Council, and particularly the President, of the I.E.E. were very anxious to push the Institution. The suggested qualifications for membership were as follows:—

Members.—Members shall be engaged in the business of electricity supply, and shall be corporate members of the I.E.E.

Associate Members.—Associate members shall be persons of good general education engaged in the business of electricity supply, and they shall have had at least one year's training at an approved technical college, or two years' training at an approved firm, company, or corporation, or shall have been engaged in electricity supply in a responsible technical position for at least three years.

The full member of this association would be a corporate member of the I.E.E. There was certainly something to be said for that. They wished to raise the status of their profession. He thought the only way in which that could be done was for the Institution to get a Royal Charter, so that membership of the different classes might give the same legal status to an engineer to call himself an engineer and to practise, as in the medical and legal professions, where only by membership of the Law Society and the British Medical Association was a man entitled to call himself a lawyer or a doctor. Whether or no senior membership of this association should necessitate membership of the I.E.E. was a matter for the mass meeting. The new association would be entirely distinct from the I.E.E.—it was to have its own council. It was only suggested that membership should be dependent upon membership of the Institution. Mr. Bache had touched upon the objects very successfully. The association would do well to leave the question of status to the Institution. As regarded the question of amalgamation, he certainly agreed that there should ultimately be only one association, and that they should all come in under one banner.

It was resolved that an association should be formed in accordance with the circular sent out, and that Mr. W. J. Bache should be the delegate to the mass meeting to be held in London.

A mass meeting of engineers engaged in the business of electricity supply, convened by the YORKSHIRE LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS, was held at Leeds on Friday last, to consider the advisability of establishing an Association of British Electrical Engineers engaged in electricity supply. The following is an abstract of a full report supplied to us by a number of those present :—

Mr. W. Lang, Chairman of the Yorkshire Section of the I.E.E., was elected to the chair, and there was a large attendance. The Chairman called upon Mr. W. B. Woodhouse to explain the matter to the meeting.

Mr. W. B. Woodhouse said he had come there at the request of the Council of the Institution of Electrical Engineers to address them on a matter which the Council felt to be of very great importance to all of them. The Whitley Committee's proposals had received the approval of the Government, and the Ministry of Labour was actively engaged in assisting in the formation of industrial councils, of which it was proposed to set up one for the electricity supply industry. The industrial council was a body composed of associations representing on one side the employers, and on the other side the employés. The employers were being organised, and that meeting was not concerned with them. The operative workmen were being organised through their trade unions. The class of engineers who were responsible for the management and executive duties were not fully organised. The position of that class of men was a rather special one; they were for the most part the employers' representatives in relationship to the workmen generally, as well as occupying their own special position in their individual capacity as employés. Because their position was such a special one, it was felt that an association to represent their interests was necessary. They should be regarded as belonging to a profession as honourable and distinguished as that of doctors, dentists, and accountants, and ought to be able to close the door to the unqualified man, so that on man should practise as an electrical engineer unless he had been properly trained and was a recognised member of the associations which included all the properly trained men of the country. The first step to the attainment of that object was to form an association in which all well-trained men at present engaged in the profession of electrical engineering should be included, and then to lay it down that in future they would not take any man into the association unless he was well trained. He would be told, no doubt, that there were already associations in existence with these objects in view, and that another association was not necessary. He thought it was necessary that, whatever organisations existed at present, they should all be brought into one association. If that was agreed to, the next point to be settled was the dividing line between the supervising engineer and the operative engineer, who might be called the mechanic. The test dividing these two classes should, he thought, be an engineering one, and one which would be recognised by outside bodies. The Council of the Institution thought that the existing qualification of membership of the Institution might well be used to divide the executive engineer from the working engineer. It was suggested for discussion that if they had some outside qualification, such as the Institution had suggested, they would be in a much stronger position than if they set up a qualification in their own existing associations, not one of which covered the whole of the country, in regard to which, with all due respect for what had been done, none of them was sufficiently influential for the Government departments or the public generally to say that their test must be recognised throughout the country. They wanted an organisation which would ensure for its members, as well trained and fully qualified men, adequate pay, satisfactory conditions of employment, and the social standing to which their qualifications entitled them. That could only be done if they got every engineer in the industry to join. The I.E.E. had already very nearly 7,000 members. Perhaps the I.E.E. did not sufficiently advertise what it was doing, but nevertheless it was taking an active part in matters affecting the industry, and the Council were particularly concerned to sustain and improve the status of the members, and to help their interests. The Council had, therefore, discussed this matter with a provisional committee representing the Incorporated Municipal Electrical Association, the Electrical Power Engineers' Association, the Chief Technical Assistants' Association, and the Associated Municipal Engineers of Greater London, and with these representatives it had been agreed that something ought to be done, and that the I.E.E. might take an active part in doing it. Therefore the Institution had organised meetings throughout the country through the agency of Local Sections. Meetings had been held at Newcastle and Glasgow, at both of which it had been decided to appoint delegates to attend a meeting which it was proposed to hold in London, where a final decision could be taken in consultation with representatives from all parts of the country. He moved :—"That this meeting of electrical supply engineers of Yorkshire, promoted by the Yorkshire Section of the I.E.E., supports the formation of an association of British Electrical Engineers, and appoints delegates to represent it at the mass meeting to be held in London under the chairmanship of the President of the I.E.E."

Mr Campion seconded the resolution

Mr. Lunn (Manchester), speaking as Northern Division President of the E.P.E.A. and an Associate Member of the I.E.E., said that he wanted particularly to bring home the fact that in regard to the present matter the E.P.E.A., which had been doing such great work during the last six months, was being ignored, as if it did not exist. That Association had covered practically the whole ground that Mr. Woodhouse had mentioned. He believed he was backed up by the whole of the members of the E.P.E.A., numbering over 1,000, in making his protest against the present line of conduct of the I.E.E. The electrical engineers waited years to see what the I.E.E. would do, and it had done nothing, and now, when they had started themselves and had just nicely got going, they found that the ground was being covered again, and the E.P.E.A. was treated as if it did not exist. Yet the E.P.E.A. included many chief engineers and deputy chief engineers and assistants, and in the Northern Division alone—particularly within 20 or 30 miles of Leeds—had a membership of over 400 qualified engineers. Not a man had been admitted into the Association unless he had the qualifications. He was not antagonistic in any way towards the I.E.E., but he felt that the supply engineers did not want fathering in this matter by the I.E.E. They could not understand a protective organisation starting from the top. They felt that it should certainly start from the bottom. They needed an organisation which was going to define the line between the brain worker and the manual worker. They had seen the manual worker receiving magnificent rewards in many cases, whilst the brain worker—the supervising worker, as Mr. Woodhouse had called him—had been receiving nothing. That was one reason why they had started; and they had gone on gradually building up and up on the lines indicated in the statement of objects and constitution of the E.P.E.A., which he read in full. The E.P.E.A. should, he thought, certainly claim priority over the A.B.E.E.

Mr. Webber (Keighley) said he thought that though the E.P.E.A. was a very useful institution, it did not include the bulk of the chief men of the profession, and never would do so; further, the Institution had a status that no association which had been formed recently could have, and, in his opinion, if they were going to have any success in getting the same grade as doctors and the legal profession, and so forth, it must come through a national institution like the I.E.E.

Mr. P. Furness (Dewsbury) read a report on the proceedings of the West Yorkshire Section of the E.P.E.A. since its formation, and stated that the membership of the section totalled 110. A sub-committee had been formed to see that the Association was properly represented on the Whitley Council. The Association was to be represented at a meeting convened by the Ministry of Labour, to be held in Manchester on June 19th, for the purpose of putting into operation the Whitley Report, and if it had not been for the action of that Association there would not have been any representation of the skilled technical staffs of electricity supply undertakings at that meeting.

Mr. W. A. A. Burgess (Huddersfield) said he welcomed Mr. Woodhouse's statement that the proposed new association was aiming at unity. He thought that all the existing associations, with the exception of the E.P.E.A., had expressed their willingness to be members of branches of any new association which was formed with a similar object. He did not think, however, that the association proposed by Mr. Woodhouse was sufficiently broad in its basis. It should include all electrical engineers, and be country-wide.

Mr. J. E. Ellis (Morley) said it appeared to him that there was a flood of new associations and societies springing up professing to have objects which were almost as bewildering in variety as the war news was. These associations were formed on all sorts of lines, but there was only one which was formed on business lines, and for that reason had taken firm root hold. That was the E.P.E.A., of the local section of which he was the chairman. From the scientific point of view, the Institution had served its purpose remarkably well, but it had failed to bring itself into line with the democratic feelings of the majority of its junior members, and had done absolutely nothing towards improving the conditions of their employment and bringing these up to date and in line with the present-day conditions. Wages were in many instances miserably low for the responsibilities borne and the services rendered by a large number of the junior members, notwithstanding the fact that the chiefs of these juniors were mostly the leading men of the Institution. Therefore, could they wonder if these members were dissatisfied with what the Institution had done for them—or, rather, what it had not done—and that they should combine and form separate associations of their own" He failed to see why the meeting should give the Institution a mandate to try and accomplish something that it had proved so utterly incapable of doing.

Mr. W. F. Mylan (Sheffield) said that he wished to draw attention to the danger arising from the multiplicity of associations, and to suggest that delegates should be appointed from the meeting to consider the advisability of either forming a new association, or recommending the members to join one of the associations which were already existing or in course of formation. For many years he considered the Institution had done very little to further the progress of the engineer, and he very much doubted whether it would be right under the circumstances to proceed with a new association which was going to be fathered by the Institution, although that body had done very good work as a scientific and academic society. In order that the meeting might appreciate what the feeling was on the manufacturing side, he read a telegram which had been sent to him stating that representatives of the employes of a number of large firms, including B.T.H., Siemens, Ferranti, Brush, Reyrolle, Electrical Apparatus, and Westinghouse, strongly disapproved of a trade union formed under the supervision of the Institution of Electrical Engineers, and declaring that as effective control by the members was essential for a healthy organisation, it would be better to consider the possibility of independent action by all classes of engineers.

Mr. R. C. Atkinson (Leeds) said the last speaker had touched the crux of the whole matter. He thought that if they would look at the rules drafted by the Committee of the West Yorkshire Section of the E.P.E.A., they would agree that those who had drawn up the rules had been fully alive to the wider issues that were at stake in the matter, and also to Mr. Mylan's point about the necessity of any protective association being under the control of those whom it wanted to protect, not under the control of those whom the members had got to be protected against. The E.P.E.A. had been in existence for a considerable time, and had been doing good work. The Northern Division had had a committee in consultation with the Chief Engineers' Association of Lancashire and Cheshire, and had been complimented by the chief engineers upon the fact of having arrived at a basis on the salaries question, which was acceptable to all parties. A good deal of use had been made by the Institution of Mr. Bostell's name (Chairman of the E.P.E.A.), and he thought this was without warrant altogether. Mr. Bostell had an invitation to attend a meeting in his personal capacity, and they had been trying to say ever since that he was representing officially the E.P.E.A. at that meeting. It was claimed on the strength of that, that Mr. Wordingham was conferring with the officials of the E.P.E.A. with a view to incorporating that enterprise with the work of the Committee which Mr. Robinson represented. It seemed to him that that was stretching the long bow very considerably. The I.M.E.A. in the spring of this year passed a resolution determining upon joint action with a view to stopping the "objectionable practice" of "technical assistants engaged in electrical undertakings being induced to accept other positions." That, apparently, was their idea of protecting the interests of the staff, and these were the gentlemen who were asking the staffs to join their association to protect their interests. The E.P.E.A. had got a statement in one of their objects in the rules to cover that, because they maintained that that was one of the liberties of the subject. As to chief engineers joining the E.P.E.A., they quite agreed to that, provided that those gentlemen were qualified. He proposed the following amendment:—"That this mass meeting of Yorkshire electrical engineers, called by the Council of the I.E.E. to support the proposed A.B.E.E., is not satisfied that this new association is being formed in the interests of the majority of the profession, as apparently the majority of those who have promoted it are senior members, and some have, so recently as three months ago, been associated with reactionary policies directly antagonistic to the legitimate interests of the junior members of the profession who compose by far the majority of it; also, bearing in mind the foregoing, and the fact that in the past the Council of the I.E.E. has done nothing in the interests of the lower grades of the profession, and that there are already in existence two strong associations, the E.P.E.A. and the B.E.A.T.A., the former covering the power-supply section and the latter the manufacturing section of the industry, who have been actively at work for many months past, and have already achieved a considerable measure of success with benefit to their members, who include all grades of qualified engineers, this meeting strongly disapproves of the action of the Council of the I.E.E. in fostering the proposed A.B.E.E., instead of the existing association, and is not prepared to endorse their action or support the proposed new association; and hereby (1) instructs the delegates to be appointed later at this meeting to attend any further meeting or conference in London or elsewhere to represent this meeting, and to make known its views; and (2) the secretary of this meeting to publish in the technical Press a full and unedited report of this meeting. Finally, this meeting pledges itself to support the E.P.E.A. and the B.E.A.T.A."

Mr. Howard Brown (Bradford) said he would like to know whether, if the proposed new association was formed, the officials of it would be the Council of the Institution, or if it would be controlled or governed by persons elected by the members themselves. It was very desirable that there should only be one organisation to be able to speak in this connection for the whole of the electrical industry, and that that association should include on the one hand chief engineers of the great cities and towns, and on the other hand sub-station engineers. If a new association was formed it should be controlled by persons elected by the members.

Mr. S. Simpson (Bradford) said that he had made inquiries as to whether the Institution had approached the E.P.E.A. to find out particulars concerning it. He gathered that the secretary had never been approached, and the association had been ignored. The E.P.E.A. had been formed with democratic purposes, and he wanted it to remain democratic. From information which he had from the President of the B.E.A.T.A., which covered the manufacturing side, he found that there was the fullest harmony between the two associations, which were working on parallel lines. He was convinced that the E.P.E.A. was working on the right lines, and only needed the unanimous support of electrical engineers throughout the country.

Mr. Campion (Dewsbury) said that by its constitution the Institution was debarred from taking any action of a political character. He asked for loyalty to the Institution at a time when men were working under a good deal of strain. It would be the very worst thing they could possibly do if they turned down the resolution. The whole idea was to get representation before anything was done under the Whitley Report.

Mr. Woodhouse, in reply, said the discussion seemed to have turned almost wholly on the very popular cry that the Institution was no good. The cause of the supposed offending of the I.E.E. in the present instance appeared to be that they had not sufficiently recognised, or, at any rate, not fully conveyed their recognition, of the very valuable work done by the E.P.E.A. The Institution did, in fact, appreciate how good that work was, but there were other organisations which had also done good work, and it would be invidious of the I.E.E. to pick out one of the existing associations and say that it represented the whole industry, because it was certain that no existing association could claim that. Therefore, the London meeting would settle who should represent the whole electricity supply industry. The people who were going to manage the new association were the members of that association, and it had never been intended that the Institution should take any direct hand in the management. It was proposed that an entirely separate organisation should be formed, the rules and regulations of which should be drawn up by those who became members of it. He had no doubt that the very excellent rules which Mr. Lunn had read out would be a good starting point. The people at the London meeting would choose their own officials, and run their own society throughout. He sincerely hoped that they would not say that, because the merits of one association or another had not been fully recognised, they would not go to the meeting in London and discuss the formation of a national association.

The Chairman said they had before them a resolution proposed by the Institution, and the meeting had been convened by the Institution, who had paid the expenses of it. There was also an amendment, and he wished to make it quite plain that if they refused to pass the resolution it meant that they refused to take advantage of the opportunity which the Institution had offered to them of sending delegates to attend the meeting in London. If, on the other hand, they decided to accept the invitation, they would choose the delegates themselves, of course.

Mr. Atkinson pointed out that his amendment, like the resolution, also provided for the sending of delegates to London.

The Chairman said if delegates were sent by instruction of the amendment they would not have the invitation of the Institution.

Mr. Atkinson: They would be the delegates of the meeting.

The point was discussed at some length.

The amendment was then put to the meeting and declared by the Chairman to be carried by 66 votes to 28.

The Chairman: I think that terminates the meeting.

Mr. Atkinson: There are delegates to be appointed, Mr. Chairman.

The chairman left the chair, and the meeting terminated.

A similar mass meeting was held at Birmingham on Monday last; the official resolution was passed, and delegates were appointed. A report will appear in our next issue.

THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.

A meeting of the Electrical Power Engineers' Association (Southern Division) was held on Monday evening at St. Bride's Institute, Fleet Street, E.C. Mr. C. H. Wordingham, President I.E.E., was in the chair. There were over 200 engineers present.

A paper was read by Mr. A. C. Bostel on "Trade Union Registration and Societies Incorporated," in which he traced the history of the growth of combinations of workers and employers, and pointed out the differences between the legal status of registration and that of incorporation. The paper had been written for the combined purpose of explaining the reasons which had weighed with the National Executive Council of the E.P.E.A. in deciding upon registration, and of demonstrating to those engineers who had objected to join the E.P.E.A., because of that decision, that under the existing State arrangements for Industrial Councils membership of a trade union became essential. Meanwhile the Institution of Electrical Engineers had removed the stigma that previously attached to a corporate member who was also a trade unionist, and it had been decided that the proposed Association of British Electrical Engineers should be registered as a trade union. The address of Mr Bostel therefore lost somewhat in topical value, but retained much of historical interest.

Mr. Wordingham, who had a most cordial reception, complimented Mr. Bostel on his able address, and took the opportunity of explaining the action of the I.E.E. in endeavouring to promote an all-inclusive Association of Engineers engaged in the electrical industry. The Council of the Institution had discussed the necessity for such an association for some considerable time, in view of the fact that they were in the transition stage between pre-war and post-war conditions, and thought that in regard to the important question of the reconstruction of the electrical industry the Institution, as the acknowledged premier corporate body of the profession of electrical engineers, with a membership approximating to 7,000, including all engineers who had attained eminence in the profession, was naturally responsible for taking the initiative. The Council had already formulated a scheme when it was approached by a committee which was understood to be representative, although unofficially, of the various existing sectional associations: the I.M.E.A., the Conference of Company Chief Officials, the C.T.A.A., and the E.P.E.A., Mr. Bostel, the president of the last-named, being a member of that committee. On the committee's representations the Council of the I.E.E. decided to drop its original plans and give the weight of its influence to the scheme formulated by this committee, which it accepted as covering all grades of qualified engineers engaged in electricity supply. The Council of the I.E.E. was entirely unselfish in this matter, and had only the single-minded desire to raise and maintain the status of the electrical engineer, and obtain recognition for him on any body formed by the State in the scheme of reconstruction. It was thought that the Institution, with its large membership, was an existing power which it would be folly not to make the utmost use of in any movement for the material and other advantage of all qualified engineers from chief to junior engaged in electricity supply. To collate and consolidate the views of the existing sectional associations, mass meetings had been held under the auspices of the Local Sections of the I.E.E. at their various centres, and at West Yorkshire, to his surprise and regret, there had been hostility on the part of the members of the E.P.E.A. Unity was essential, and he hoped that night to hear the views of this Association, so that a step forward might be made in levelling the evident differences of opinion existing.

Mr. Law, on behalf of the Southern Division of the E.P.E.A., said they accepted Mr. Wordingham's presence that night as a happy augury of the future good relationship between the premier Institution of the profession and the Electrical Power Engineers' Association. No one could doubt the sincerity of the President of the I.E.E., and all were agreed that an association such as was contemplated was necessary. The E.P.E.A. held that such an association already existed. Their Association was by no means sectional, but was representative of electricity supply engineers, both company, municipal, and those engaged on power plants, and also engineers engaged with manufacturers. They had been invited to send representatives to the first meeting summoned by the Committee on Production to form an Industrial Council for the electrical industry.

Mr. Healy said that Mr. Wordingham had evidently an incomplete knowledge of the scope and objects of the E.P.E.A., and traced the history of the development that had taken place from August last. He felt that the work done and the achievements recorded throughout the country warranted the claim of the E.P.E.A. to look upon the proposed association as merely duplication. While all were animated with the desire for complete unity, it was necessary to avoid repetition of work that had already been done.

In replying, Mr. Wordingham dealt with all the points raised, and trusted that the claims made as to who were represented by the E.P.E.A. would be substantiated. He issued an invitation to the Association to send delegates from the various divisions throughout the country to discuss the whole question with the I.E.E. On a resolution being put, this was unanimously agreed to by the meeting, and an early date was fixed prior to the mass meeting proposed to be held in London in July.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Coal Consumption in Large Generating Stations.

Having recently read the Interim Report on Electric Power Supply in Great Britain by the Coal Conservation Sub-Committee, and having also seen a letter in one of the English electrical journals (I forget which) in which the view is expressed that the proposal to establish super-stations should not be carried too far, as a greater number of stations would give more satisfactory service, I think a few comments bearing on this subject may be of interest.

I had occasion not long ago to investigate, in a fairly thorough manner, the rates of coal consumption obtaining in many steam-driven generating stations in Canada and the United States. Records from many stations were obtained, and these were divided into various classes as follows:—

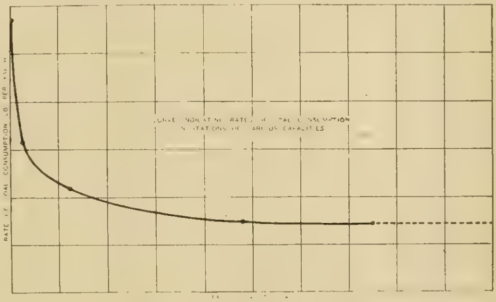
Class A.—Stations up to 1,000 KW. capacity.
Class B.—Stations from 1,001 to 5,000 KW. capacity.
Class C.—Stations from 5,001 to 10,000 KW. capacity.
Class D.—Stations from 10,001 to 50,000 KW. capacity.
Class E.—Stations from 50,001 to 100,000 KW. capacity.
Class F.—Stations above 100,000 KW. capacity.

The records covered, in all, some 155 station-years of operation; those of most of the individual stations covered five years, and a few four years, but in no case less than the latter figure for any one station.

There was only one station in each of classes E and F, but as the records of such large stations are usually kept with greater accuracy than those of smaller stations, it was considered that the degrees of accuracy in the various classes would thus be approximately balanced.

The figures for the different stations in each class were averaged, and a curve was drawn representing the rates of coal consumption per KW.-hr. in each class of station.

Naturally, this curve, which is remarkably steady, starts at a high value for the small stations, and comes down rapidly as the size increases; but, at a point representing a station capacity of about 75,000 KW. the curve is almost horizontal, and shows conclusively that in existing stations the saving in coal consumption beyond this point up to a station capacity of 150,000 KW. (the largest size from which records were obtained) is quite small, amounting only to about 7.5 per cent. The saving indicated between a station capacity of 125,000 KW. and 150,000 KW. is only about 2 per cent., and beyond a capacity of 150,000 KW., with present methods of burning coal and of steam generation and utilisation, the curve holds out no hope of further appreciable economies being obtained.



Coal Consumption per KW.-HR.

Another noticeable feature of the curves plotted is that, in two stations of 95,000 KW. and 150,000 KW. capacity, having annual load factors of 37 per cent. and 44 per cent. respectively, the rate of coal consumption in the larger is only slightly over 2 per cent. less than in the smaller. Since load factor is practically certain to affect the coal consumption, this would indicate that the size of station has had no measurable effect whatever. It may here be remarked that the B.TH.U. per lb. of the coal used in the two stations referred to are almost identical, being, however, slightly higher for the smaller station, which would indicate that, with identical fuels, the larger station might show up a little better than it actually does. The difference, however, is only about 3 per cent., and would probably be accounted for by the difference in load factors referred to above.

To my mind, the argument to be drawn from the foregoing is that station capacities beyond 125,000 KW. or 150,000 KW. will be of no benefit whatever in appreciably reducing actual coal consumption in the electric generating station itself, unless the load factor can be *very materially* increased over that at present obtained in most steam-driven stations. On this continent load factors of over 90 per cent. are to be found at many of the large hydro-electric stations at Niagara Falls and elsewhere, but half of this may be considered a high value for even the very large steam-driven stations.

In super-stations, of course, economies may be made in capital expenditure, operating costs, &c., and the gasification of the coal and the obtaining of by-products may be more feasible at very large stations than in those of more moderate size; but that the question of putting one's eggs into very few baskets, instead of segregating them a little more, is worthy of very serious consideration, especially in view of the facts here presented in regard to actual coal savings obtainable in the two cases, before any definite scheme is embarked upon, seems evident. The diagram herewith represents approximately the shape of the curve mentioned above.

Alfred S. L. Barnes.

Toronto, *May 30th*, 1918.

The I.E.E. and the Proposed A.B.E.E.

We, the undersigned, Corporate Members of the Institution, protest against the action of the Council in spending Institution funds in financing the proposed A.B.E.E., as admitted in the Secretary's letter of the 12th inst. to Mr. Atkinson. It appears to us that this use of the Institution funds by the Council is *ultra vires* in view of paragraph 4 of the Memorandum of Association and of article 56 of the Articles of Association.

The amount of the expenditure is probably not large so far, but the matter is one of principle. We believe the Council acted without realising that their action was an infringement of the rules of the Institution, as we contend, and we think the secretary has been remiss in not keeping them better informed. We consider the Council should forthwith repudiate all liability in connection with the proposed A.B.E.E., and leave its promoters to foot the bill themselves, or else get their prospective members to do it.

The Whitley Report was issued in March, 1917, and the E.P.E.A. (of which we are also members) was established in the early autumn of the same year, with objects which the proposed Association of British Electrical Engineers appears to have made a very good copy of, even to registration as a trade union, which the Council of the I.E.E. at first refused to agree to (see technical Press, April 5th, 1918).

The membership of the E.P.E.A. is considerable (over 1,000, and daily increasing), and includes already a considerable number of chief engineers and other senior executive officials on the power supply side of the industry.

The E.P.E.A. has had to pay its own preliminary expenses, but when certain London members in touch with the Council of the I.E.E. propose to form a rival association to the already-established E.P.E.A., the Council agree to pay the preliminary expenses of the proposed association, including the hiring of halls for mass meetings, and the travelling expenses of the promoters, out of Institution funds.

In our opinion, this shows a lamentable lack of impartiality on the part of the Council, and, what is more serious, that they are out of touch with the feeling amongst the majority of the younger members of the Institution.

We are told the Council wish to see one association only representing the electricity supply engineers, and we concur in this wish. But why, then, do the Council foster the formation of another when there are already in existence two associations, viz., the C.T.A.A., claiming to represent the senior members only amongst electricity supply engineers (and, therefore, a minority of the whole), and the E.P.E.A., who include in their membership all grades of qualified electricity supply engineers from top to bottom?

We suggest that the Council's action has been hurried and ill-advised.

To suggest a conference composed of delegates from mass meetings (some of which have been held in centres where no definite steps towards organisation have yet been taken, and, therefore, where there is presumably no considered opinion) is surely putting the cart before the horse.

If the Council are desirous of harmony in this matter it appears to us that instead of holding mass meetings, the President might ask the existing Associations, viz., the E.P.E.A. and the C.T.A.A., to meet him in conference, such conference to be on the basis of proportional representation of their respective memberships, say, one representative for every 100 certified members.

The proposed Association of British Electrical Engineers (Supply Section) would not, of course, be entitled to representatives at this conference, as it does not exist except in a provisional sense. By means of this conference we think the Council would then be taking a course which would appeal to all fair-minded men as evidence of a genuine desire to obtain the considered opinion of those who have had the vision to take the initial step in the formation and organisation of the existing associations.

Failing this, we think they would do better to let the various associations, including those representing the interests of the manufacturing engineers, work out their own destiny in their own way, and, probably, of their own accord affiliate, and then, possibly, claim recognition from the I.E.E., seeing that a considerable proportion of the membership of the I.E.E. will undoubtedly be included in the affiliated associations.

The work the I.E.E. has done in the past in its prescribed sphere of action, we believe all reasonable men will agree, has been good (though opinions may differ as to whether it might not have been better and more energetic), and has made the Institution respected the world over, in spite of the tendency during recent years of some consulting engineers to use its meetings as advertising media in a most brazen fashion. It is a pity, therefore, that this respect should be endangered by actions which, in the opinion of many people, are hasty, ill-considered, and by no means impartial, and which, if persisted in, will, we feel sure, weaken the Institution's influence for good in the electrical industry.

R. C. Atkinson, A.M.I.E.E., A.M.I.C.E., A.M.I.M.E.
Sidney Simpson, A.M.I.E.E., Assoc.A.I.E.E.
R. D. Spurr, A.M.I.E.E.
G. Morgan, A.M.I.E.E., A.M.I.C.E.
A. R. Chaytor, A.M.I.E.E.
P. Furness, A.M.I.E.E.

Coal Economy and National Health.

Lord Moulton, speaking at the annual conference of the Institution of Gas Engineers, is reported as having urged that gas and electricity should be placed on an even footing, and charged for in proportion to the amount of energy (heat) supplied to the consumer.

This would mean that a quantity of gas or a quantity of electrical energy, each equivalent to the same quantity of heat units, would cost the consumer the same amount of money. On this basis, if electricity were charged for at 1d. per unit, then the price of gas would have to be about 12s. 6d. per 1,000 cu. ft.

Of the heat produced by the gas, only a substantially reduced proportion can be usefully applied to the needs of the consumer, whereas in a well-designed electric fire or oven there is very small waste of heat. This fundamental difference is due to the inherent necessity of maintaining a draught during the burning of the gas, which draught carries away, into the outside air, a varying proportion of the heat produced by the gas flame.

Owing to this inseparable waste in connection with gas-produced heat, it would appear that gas must always be sold at a lower price than electricity as measured by their respective *gross* heating values, because the *net* heating value of gas to the consumer is inferior to the *net* heating value of electricity.

If Lord Moulton is correctly reported, he would seem to be advocating conditions that would give gas a very poor chance in the market, because it is inconceivable that anyone would use a gas fire on such terms of payment.

The framers of the new scheme for rationing coal, gas, and electricity have based their alternatives on sound lines, and, whether intentionally or not, allowance is made for waste of gas-produced heat. We are permitted to purchase either 750 heat units from the gas works, or 273 heat units from the electricity works, but the *net* value of these to the consumer will not be in anything like the same proportion. A mere statement of this kind is valueless without some evidence to support it, and I will, therefore, cite, as an example of the extraordinary economy of electrically-produced heat, a test that I recently made of an electric furnace for tempering steel. I found that I was able to maintain the required temperature of 900 deg. C. for one hour, with electricity equivalent to 6,000 heat units (exactly 5,971), whereas the gas furnace makers, for a furnace of the same size, require a consumption of gas equivalent to 75,000 heats units, which means that 69,000 gas-produced heat units must be blown away to waste in warming the wide world instead of the furnace. In this calculation I have assumed that the value of the gas is 500 heat units per cubic foot, which is a fair average value.

This brings me to the main point that the 75,000 heat units would call for the carbonisation at the gas works of about 30 lb. of coal, against only about 6 lb. of greatly inferior coal used at the electricity works in attaining the same result.

Fortunately, the fine-quality coal used at the gas works yields coke and other valuable material for explosives and agriculture, and from the national point of view the gas works to-day are most important. That is no reason, however, why we should use gas for heating and cooking in a wasteful manner, when it could be very much more efficiently and beneficially employed in developing power in a gas engine or boiler.

A few words should be spoken into the public ear from the point of view of national health. Gas fires have met with considerably advertised testimony from medical men, but these all insist that the gas fires must be *properly fixed*. In other words, the flues must be kept clean, and free to carry away the products of combustion. In my own home, where I have electric fires, as well as the previously fitted gas fires, I have had to lengthen the flue pipes, and these should project at least 12 in. up the chimney. As originally fixed, the flue pipes terminated under, and did not project into, the chimney at all, and the atmosphere of the rooms soon became oppressive and unhealthy. This objectionable feature has been largely remedied by the alteration.

I wish strongly to emphasise the view that the country is putting gas to the wrong purpose in using it for heating and cooking, and we are thereby wasting coal.

C. Orme Bastian.

London, W., *June 11th*, 1918.

Labour and Bulk Supply.

On Tuesday, June 11th, a deputation comprising the Parliamentary Committee of the Trade Union Congress, and representatives of the Electrical Trades Union Executive, waited on the President of the Board of Trade, and put before him the views of organised labour on the national electric power schemes, and the report of the Coal Conservation Committee, with reference to the labour employed in power and sub-stations. The proceedings were private, but a report will be issued to the members of the Station Engineers Branches of the Electrical Trades Union.

H. H. Morton,
Secretary, Electrical Trades Union.
London Station Engineers, No. 1 Branch.

London, S.E., *June 14th*, 1918.

The Electrical Propulsion of Ships.

I have noted with interest the report of Mr. Eskil Berg's paper on "Thermo-Electrical Ship Propulsion," published in your issue of May 10th last, and the very ingenious reply to it by Mr. Stanley S. Cook in your issue of the 14th inst. As the inventor of the thermo-electrical propulsion system as used on the *New Mexico*, I would esteem it a favour if you would kindly allow me to pass a few remarks on the subject.

I am in perfect agreement with Mr. Cook that a propulsive efficiency compared with the shaft horse-power of 75 per cent. is out of the question. The *Lusitania* design had the supposed pick of the British talent put into it, and even this resulted in a propulsive efficiency of only 48 per cent. compared with the shaft horse-power, and this with propellers running at 190 R.P.M. at about 26 knots, requiring no less than about 70,000 shaft horse-power to overcome the resistance of just over 33,000 E.H.P. Had she been fitted with the "Paragon" system, with propellers running at a speed of 80 R.P.M., only 55,000 shaft horse-power would have been required to give the vessel the same speed, with the same displacement, the propulsive efficiency being no less than 61 per cent. It is, therefore, quite possible that after the official trials we shall learn that the propulsive efficiency for the *New Mexico* compared with the brake horse-power of the electric motors will be somewhere about 63 to 64 per cent., at her designed speed of 21 knots. I think that with full evaporation her spurt-speed will be more like 23 knots for a period of about one hour.

In raising the thermal-propulsive efficiency of ships, in the manner in which it is being done in the actual ships at work, there is an important reduction in weight (which means displacement and work), and also in properly designed plant, a material reduction in capital cost in connection with the "Paragon" plant.

It would be of interest if Mr. Cook could tell us where the vast improvement has taken place in the direct drive during the last 10 years, and also how he makes out a proper case of a 10 per cent. extra efficiency in favour of the geared turbine drive. To state that there is 10 per cent. extra efficiency in favour of the geared turbine drive is absolutely misleading, and "Paragon" ships already at sea for several years have proved this to be correct.

Any improvement in a steam turbine can be equally applied to either system of transmission, but the thing Mr. Cook leaves out of the argument is that at the present time it is not economically possible to bring about such a high ratio of reduction with gears as is being done with the electrical transmission, and thus the thermo-dynamic efficiency is in favour of the "Paragon" drive.

In the case of the single-reduction gear used on the *Neptune*, a reduction of only 9¼ to 1 was used, whilst in the electrically-driven *Jupiter* a reduction of no less than 18 to 1 was successful in gaining supremacy as tested at sea against both the latest design reciprocating steam engine and the geared turbine drives.

The vessels in hand at the present time run into many millions of pounds of capital, they include 150 cargo vessels of 3,000 tons, several high-speed passenger vessels, no less than seven modern super-dreadnought battleships, and five fine high-speed battle cruisers, each installed with 135,000 KW. of electric power, estimated to give them a sea speed of 35 knots.

William P. Durtnall.

London, S.W., *June 15th*, 1918.

WAR ITEMS.

Entertaining the Wounded.—On Friday afternoon last at the Church Hall, Leyton, Mr. H. Hirst gave an entertainment for wounded soldiers from local hospitals. It took the form of a grand assault-at-arms by the City and Metropolitan Police Athletic Clubs, H.M. Life Guards, and members of other well-known clubs. Mr. Hirst was present, as was also Major-General Sir Newton Moore, K.C.M.G., one of the new directors of the General Electric Co., Ltd. The arrangements were under the direction of Sergeant A. R. Mugridge, of the City of London Police. The entertainment, which was enjoyed by about 300 wounded men, was a great success in every way.

Control After the War.—While we believe there is very good ground for the Government view, as revealed more especially by the Ministry of Reconstruction and as approved by the House of Commons, that if Government control of industry and supplies were withdrawn immediately after the war a state of chaos and scrambling would ensue, that opinion is not held by some leaders of industry any more than by some merchants. For example, Mr. A. F. Pease, of Pease & Partners, as reported, considers that Government control ought to be abolished immediately hostilities cease. He sees no reason why trade should not be put on the normal basis of supply and demand the day Peace is declared. But what about the rationing of raw material, the organisation of the priority, or otherwise, return of suitable labour; what about the conflicting claims of essential and unessential industries to both of these? Can the Allies co-operate in the great work of returning to normal conditions if there be no control? In the coal trade Mr. Pease expects a hiatus between the time when the Government requires enormous munitions and the time when things return to the normal state. Men and soldiers who have worked and fought hard and continuously will need a holiday, and Mr. Pease thinks it may be necessary to shut down some works for a time. Probably it will be, but in all our thinking about after-the-war conditions we need to remember that demobilisation, owing to shipping and other conditions, will necessarily extend over a lengthy period. There will be some definite order about the return of men and the availability of material for restarting or continuing industries, public works, building operations, and so forth. We all find Government control extremely irksome, and the Government itself says that it wants to release its hold as speedily as possible, but surely even Mr. Pease must in his heart of hearts feel that the sudden release of that hold would land us in just that state of confusion that it is so necessary for us to avoid.

American War Notes.—Several interesting references to American electrical men's activities in connection with the war appear in the *Electrical Review and Western Electrician* for May 25th. We observe that Major A. A. Gray, formerly managing editor and vice-president of that journal, organised the Technical Publicity Bureau, Ordnance Department, Washington, D.C., for the purpose of co-ordinating the work of that Department with the industries through the medium of the trade and technical Press. Mr. M. C. Turpin, who has been connected with the Westinghouse publicity department for the past nine years, has become assistant to the manager of the above Bureau. Mr. C. A. Coffin, chairman of the General Electric Co., Schenectady, and head of the Franco-American Clearing House in New York, has the distinction of being the only officer of the Legion of Honour in America. The honour was conferred upon him by the French Government through M. Justin Godard, who has been in the States on a special mission, at a dinner on May 13th, in recognition of Mr. Coffin's services rendered as a member of the executive committee of the War Relief Clearing House for France, which is now under the direction of the Red Cross, and his efforts to promote the establishment of scholarships in French Universities for American students after the war.

The employés of the Westinghouse Electric & Manufacturing Co. and its subsidiaries subscribed $2,601,000 to the third Liberty Loan, $2,217,000 representing the subscriptions of the employés of the parent company, 32,048 finding $69.18 per capita.

Trading with the Enemy.—The "London Gazette" for June 14th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentine, Paraguay and Uruguay, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico, Netherlands, Netherlands East Indies, Norway, Persia, Peru, Portugal, Salvador, Spain, and Venezuela.

Non-Ferrous Metal Licences.—The "London Gazette" for June 14th contains a further list of those to whom licences have been granted by the Board of Trade under the Non-Ferrous Metal Industry Act.

Trading with Russia.—In the "London Gazette" for June 14th there are given particulars of further territory in Russia which is in hostile occupation.

French After-War Resources.—The order that a report shall be made upon the resources of France, and upon her probable economic needs immediately upon the declaration of Peace, has been published by the ministry of Commerce. Numerous private concerns have been occupied in collecting useful data for a long time past.—*The Times*.

Bolting the Door Against Bosch.—Reuter's Melbourne agent states that Mr. Jensen, the Commonwealth Minister of Customs, has prohibited the importation of magnetos bearing the name of Bosch, thus amending the former order applying only to Bosch magnetos manufactured in Stuttgart.

Federation of American Industries.—The New York correspondent of the *Times* states that the splendid support which the manufacturers of America are giving to the Government was emphasised at their War Convention on June 14th at Atlantic City, where the leading industrial representatives of the Eastern States, after pledging the unfaltering devotion of their resources to the war purposes of the Administration, set in motion a movement for the establishment of a great federation of industries of the country, embracing 300,000 large and small plants, employing 10,000,000 workers. "Give us such an organisation, linking the manufacturers of this country into one great federation," declared the chairman, "and there will be no problem during or after the war that it cannot solve."

Exemption Applications.—At the Brighouse Tribunal, F. Walker (30, Class A), an electrician employed by Mr. J. Kilburn, Victoria Mill, Brighouse, had his appeal dismissed.

At the South Shields Tribunal, the list of appeals included 26 cases from the Corporation tramways department. The National Service Representative said the re-examination result was that there were now only two Grade 1 men. Three were in Grade 2, 12 in Grade 3, two were rejected, and one held a final discharge. The tramways manager, Mr. J. C. Whiteley, read a letter from the Board of Trade Tramways Department stating that instructions had been received from the Ministry of National Service to the effect that the calling-up notices of men below Class A or Grade 1 were to be cancelled, and the calling-up of the men in the higher category was to be postponed until June 20th. The appeals of the two Grade 1 men were disallowed, the men to be called up on June 20th, and in the remainder of the cases conditional exemption for six months was granted.

At Colchester, five tramway employés were appealed for by the Corporation, four being in Grade 3. Three were granted six months' exemption, another was conditionally exempted, and the other man was ordered to be graded.

At Bridlington, the Corporation asked for exemption for the electrical engineer, and a mechanic and relief stoker

(Class A 2) at the electricity works. The former was exempted until September 1st, and the latter, who was last examined in 1916, is to be regraded.

At Bath, there were reviews of the cases of W. G. Clothier (35), traffic inspector with the Electric Tramways, Ltd., and A. W. Wadley (34, Grade 2), the only overhead linesman with the company. As the former's grading has been lowered from 1 to 3, the exemption was continued, and in the latter case it was admitted that Wadley was in a certified occupation, and the same decision was registered.

At Carlisle, the Tramway Co. appealed for R. J. Cooke, driver and traffic inspector. It was stated he had general supervision of all the drivers and conductors. They had no man above Grade 3 except Cooke, who was in Grade 2. It was essential that the cars should run; it was obvious that the man was doing very important public work. The staff had been depleted from 40 to 16. Exemption was refused.

At Eastbourne, in the case of G. Chuter (33, Grade 2), engaged on repairs, meters, wiring work, &c., at the Corporation electricity works, he was given 12 weeks' exemption, when his case will be considered with those of others of the staff. He is to be substituted if possible. In the case of another employé, aged 41, and in Class C 2, the National Service Representative withdrew his appeal against his exemption.

At Bourne (Lincs.), exemption until September 1st was granted to C. H. Robinson, of Grimesthorpe, electrician to the Earl of Ancaster.

At Grantham, the Urban Electric Supply Co., Ltd., appealed for T. W. Heritage (28, Grade 1), superintendent; N. W. Lockton (30, Grade 1), stoker; and A. Parnham (33, Grade 1) and P. A. Baxter (28, Grade 1), wiremen. The first two were each granted a month, and the others three months each.

Kendal Tribunal has given exemption until November 1st to F. Collinge (35, Grade 3), electrician, and A. T. Barnes (42), electrical engineer.

The Hastings Tribunal has granted three months' exemption to an employé of the Tramway Co. named Morris, who is in Grade 3.

Folkestone Tribunal has granted three months, with the Volunteer condition, and with leave to apply again, to the following employés of the Electricity Co.: Messrs. Cooper (38, Class A), engine driver; Watkin (40, B 1), sub-station engineer; and Sutcliffe (37, B 1), fitter.

At Exeter, appeals were made by the City Council for F. R. Potter (43, Grade 1), G. Hutchings (43, Grade 2), and J. Gilliard (43, Grade 1), tramway employés. Mr. Baldwin stated that Potter and Hutchings were drivers and in a certified occupation, and had been wrongly called up. The Mayor stated that the military had no right to grade the men, and that the proceedings were *ultra vires*. The Military contended that the men were not registered as drivers, but in an occupation which was not certified. If they had notified their change of occupation they would not have been called up. The Tribunal gave each exemption so long as they continued in the certified occupation. Gilliard was stated to be a platelayer, and the Mayor said that it would be futile to exempt the drivers and not the man who enabled the trams to run. Exemption was refused as from June 26th.

The East Kent Appeal Court has dismissed an appeal filed by R. Clarke (41, Class A), electrical fitter with Messrs. Webster & Co., of Folkestone.

East Ashford (Kent) Tribunal has given six months' exemption to H. T. Dew (46, Grade 1), electrical engineer, of Kennington.

At Brixworth (Northants), on a National Service appeal, conditional exemption granted in 1916 to a man in charge of the electric light plant at a V.A.D. hospital, aged 40, was cancelled, and final exemption to August 31st substituted.

At Burnham (Somerset), the National Service Representative asked for withdrawal of exemption held by A. O. Mountstephens, engaged with the Electric Light Co. A month ago the case was put back to enable the Military to find a substitute, and as they have not done so the appeal was dismissed, and the exemption confirmed.

At Oxford, three months each were granted to A. W. Oakley (38, Grade 3), unit adjuster, and R. F. Haydon (30, Grade 3), driver, employed by the Tramways Co. National Service appeals filed against W. T. Cooke (27, C 1), electrical fitter with Messrs. Hill, Upton & Co., electrical engineers, and A. A. Whitaker (41, Grade 2), with Messrs. Lucy & Co., electrical manufacturers, were withdrawn, as the men are protected.

Before the Wilts. Appeal Court, the National Service Representative appealed against exemption held by W. J. Moran (34), electrician with Messrs. Bays & Co., electricians, of Swindon. It was stated that Moran had left the firm, and that he had been given six months on condition that he remained in his then occupation, as he was the only skilled electrician left to deal with that part of the firm's business. As Moran failed to appear, his exemption was cancelled.

Three months' exemption has been granted at Tonbridge to G. Spencer (36), electrical engineer.

At Houghton-le-Spring (County Durham), final exemption to the end of August was granted to an employé of the Newcastle Electric Supply Co. engaged in rebuilding boiler furnaces at the Philadelphia station.

Before the Rural Tribunal at Houghton-le-Spring (County Durham), the Military appealed against seven employés of the Tramways Co. Three general service men were directed to join up when substitutes are provided; the chief traffic manager, passed for general service, was given to the end of November, as was also the ticket and motor inspector (Grade 2). The appeals in the case of two Grade 3 men were dismissed.

At Harpenden, an appeal filed by H. J. Burgoyne (45, Grade 1), electrical fitter with Messrs. H. Salisbury & Son, Ltd., was refused, and he is to report for service by July 15th.

At Martley (Worcestershire), an appeal was made by F. Turner (37, C 1), in charge of the electric plant at Knightwick Sanatorium. It was stated that the work could not be maintained unless a capable substitute was provided. Exemption until August 31st was granted, with a view to a substitute being found.

Kidderminster Tribunal has granted exemption to August 31st to A. E. Jackson (37, Grade 3), a driver on the tramways.

At Worden, A. Cranfield (32, Grade 2), electrical engineer, of Whitworth, was given exemption until August 1st.

At the Birmingham Tribunal, Mr. A. Berkeley, electrical merchant, Handsworth Wood, Birmingham, applied for exemption. It was stated that he was married, aged 40, and passed Grade 3. The case had been previously adjourned for the man to be graded. Appellant stated that his stock, valued at over £5,000, consisted of all kinds of electrical goods. He supplied the chief controlled firms, 90 per cent. of his orders being executed on munition certificates. Berkeley added that he started business in 1903, and all his money was in the business. His present staff consisted of three girls and a man of 57. His previous staff of three men were in the Army. He was doing Special Police duty. Three months exemption was granted, with further leave to appeal, appellant to remain in the police force.

LEGAL.

The Kensington and Knightsbridge and Notting Hill Co.'s Arbitration.

On Friday, June 14th, the Court of Appeal, composed of Lords Justices Pickford, Bankes, and Warrington, commenced the hearing of an appeal by the Kensington and Knightsbridge Electric Lighting Co. from the judgment of Mr. Justice McCardie upon the appeal of the Notting Hill Electric Lighting Co. from an award of Mr. James Swinburne; the earlier proceedings have been reported in our pages.

Mr. P. O. Lawrence, K.C., Mr. Vesey Knox, K.C., and Mr. C. D. Marriott appeared in support of the appeal: and Mr. Tomlin, K.C., and Mr. Bruce Thomas for the respondents.

Mr. Vesey Knox said it was an appeal from the judgment of Mr. Justice McCardie on a special case stated by Mr. Swinburne. Two questions only were raised upon the appeal, the first being whether a supply of electricity given by the Notting Hill Co. under certain Orders made by the Board of Trade under Sec. 6 of the Electric Lighting Act of 1909 was part of the business of the Notting Hill Co. within the meaning of a clause in an agreement between the two companies made in 1900 (October 25th): and the second question was whether the supply from the joint station of the two companies at Wood Lane for the purpose of supply of those fringe Orders was within the powers of the companies jointly or severally under a special Act passed in 1899. Mr. Swinburne had found that in respect of the supply under the fringe Orders the damage to the Kensington Co. had been £1,661 up to the end of the year 1916. Mr. Justice McCardie had decided that the supply under the fringe Orders was not part of the business of the Notting Hill Co. referred to in the agreement, and that it was not within the powers of the fringe Orders to use for the purposes of the fringe Orders the supply of electricity from the joint station. Mr. Justice McCardie had held that the Arbitrator's award was erroneous in respect of the item of £1,661. His Lordship had also decided other points in favour of the present appellants, as to which there was no cross appeal.

In the course of his arguments, Mr. Vesey Knox contended that the finding of the Arbitrator was correct, and that in respect of the breach of contract the plaintiffs were entitled to the damages he had awarded, viz., £1,661 up to the end of 1916, and that there was a continuing and increasing breach of the agreement.

Mr. Tomlin, on behalf of the respondents, contended that the agreement provided that the supply was to be within the statutory area, and that a reasonable amount was to be taken. He contended that the Notting Hill Co. had taken their maximum under the agreement, and that the word "business" in Clause 3 meant the supply of electricity to the defined statutory area of the Notting Hill Co. He submitted that there was no contractual obligation of which there had been a breach.

At the conclusion of the arguments their Lordships affirmed the judgment of Mr. Justice McCardie, and dismissed the appeal, with costs.

Lord Justice Pickford, in delivering judgment, said that the "business" with which the agreement was concerned was the business of supplying electrical energy to the respective areas of supply which were authorised by the special Act, or as might from time to time be agreed upon. At the time the agreement was made they did not contemplate supplying electrical energy outside the area of supply, because at that time it was not possible, and it did not become possible until some 10 years afterwards. They had not to look outside the agreement in order to see what limitation was to be put on the generality of the word "business," because they found the limitation in the document where the word was used. He thought that Mr. Justice McCardie was right in saying that he must limit the meaning to the supply of electricity to the defendants' statutory area and to the business of the parties at the time of the agreement. That being so, the supply by the fringe orders was not "business" which came within the terms of the agreement. That was sufficient to dispose of the case. For these reasons he thought that the appeal failed and should be dismissed, with costs.

Lord Justices Bankes and Warrington also delivered judgment, dismissing the appeal.

BUSINESS NOTES.

Iron and Steel Trade Policy.—We read in the *Times* that the British iron and steel manufacturers have taken an important step for securing the future position of their industry. "They have agreed to form a National Council on trade policy. The Council will be representative of all the ironmasters of the country, and, probably, of Labour interests as well. Its function will be to obtain closer organisation of export and production, and to assure the supply of raw material. Dr. Addison has secured the assent of a representative conference of masters and men to the establishment of a second body, an Industrial Council, to deal with all labour questions in every branch of the iron and steel trade."

Book Notices.—"Motor Transport Year Book and Directory." Vol. III. 1918, c. + 317. London: Electrical Press, Ltd. Price 12s. 6d. net.

"General Lectures on Electrical Engineering." By C. P. Steinmetz. London: Hill Publishing Co. $2.50.

"Science Abstracts." A and B. Vol. XXI. Part 5. May 31st. London: E. & F. N. Spon, Ltd.

"Willing's Press Guide" (James Willing, Ltd., London, 1s.) has reached its 45th year of issue. Its contents are arranged in a straightforward and businesslike manner for ready reference.

Amendment of Patent Specification.—The British Thomson-Houston Co., Ltd., has applied to the High Court for leave to amend the specification of Patent No. 21,513/06 for the treatment of metallic tungsten, by inserting after line 6, p. 6, the following new paragraph:—"We desire it to be understood that by the expressions 'coherent form' and 'coherent metal' in the claims, we exclude any forms of tungsten other than those agglomerated from tungsten powder and rendered very dense and strong by a heat treatment very near the melting point." And in line 15, by substituting "In the" for "The" and "claimed in claim 1" for "which consists in." Notice of opposition must be given by June 26th, 1918.

Patents and Alien Enemies.—Applications have been made by the Ministry of Munitions and the General Electric Co., Ltd., to the Board of Trade to avoid or suspend Patents Nos. 29,933/10 and 894/13 granted to R. Böcking et Cie, for cleaning furnace gases, and Nos. 20,823/11, 1,214/12, 1,215/12, and 8,752/12, granted to W. F. L. Beth, for filtering apparatus for gases.

Electrical Supplies for S. Africa.—There is an acute shortage of tubing, and what little can be picked up is 2s. 6d. higher. Several decent consignments of electric lamps have arrived at the coast from Holland *viâ* England; quite sufficient to relieve any prospective shortage during the next few months. One firm also received 60 gross of blocks this week. However, business is slack, chiefly because our stocks are very low indeed. For example, concentric cable is the principal trouble to-day, as little can be had, therefore in some cases the municipal street cables cannot be connected to the house and other installations. The Japanese supplies of electrical materials are disappointing, as so much was expected, and so little has been accomplished, so far.—*S. A. Mining Journal*, May 11th, 1918.

Lists.—Messrs. Meldrums, Ltd., Temperley, near Manchester.—Illustrated circulars relating to their combustion appliances, also their castings and apparatus for chemical works.

Bankruptcy Proceedings.—A. E. Felgate & W. Storey (Felgate & Storey, electrical engineers, Reading).—Supplemental dividend, 1¾d., payable June 20th, at Official Receiver's offices, 14, Bedford Row, London, W.C. A. E. Felgate (separate estate), first and final dividend of 1½d. in the £.

Electrical Industry at Wolverhampton.—The Council of the Wolverhampton (Incorporated) Chamber of Commerce, in their annual report to the Chamber, remark:—"The demand for electrical plant during the past year has continued to be abnormal, but the difficulty of obtaining raw materials is daily becoming more serious. . . . Local factories have, we understand, been exceedingly busy."

For Sale.—Hampstead B.C. invites tenders for a Davey-Paxman boiler, Green's economiser, two steam superheaters, and six thermal storage drums. Rochdale Corporation Electricity Department invites offers for two 150-kw. d.c. generators, spare armature, Belliss three-crank compound engines and condensers. A number of d.c. motors are offered for sale at Rhondda Valley; Newcastle-under-Lyme Corporation Electricity Department invites offers for two 45-b.h.p. Stockport gas engines, coupled to two 30-kw. E.C.C. shunt-wound 220 to 330-volt dynamos, &c. For particulars see "Official Notices" to-day.

Liquidations.—Malta Tramways, Ltd.—Creditors must send the usual particulars to the liquidator (Mr. J. R. Tulloch, 4b, Frederick's Place, Old Jewry, E. 2), by July 27th.

Patent Application.—The application of Dr. J. A. Fleming and Marconi's Wireless Telegraph Co., Ltd., for extension of Patent No. 24,850 of 1904 is not to be heard before October 30th.

LIGHTING AND POWER NOTES.

Aberystwyth.—Water Power.—A Sub-Committee of the T.C. has under consideration the water power of the Rheidol Valley, and Prof. O. T. Jones is to be asked to advise on the matter, it being considered that the Rheidol can provide unlimited power for electricity purposes.

Barnsley.—Mains Extension and Price Increase.—The T.C. proposes to extend the mains to supply energy to the works of Wood Bros., at a cost of £3,000. The question of raising the charges for energy is being considered, together with an application for energy for an electric furnace, sent in by Wilson and Longbottom.

Birmingham.—Year's Working.—The annual report of the year's working of the Corporation electricity department shows total revenue £861,601: working expenses, £620,740; gross profit, £240,861; after making provision for income-tax and sinking fund charges, placing £6,727 to reserve, £39,500 to renewals and special expenditure, the balance (£25,263) has been allocated to the rates account. During the year 160,275,400 units were sold, 131,329,751 for lighting and power and 28,945,649 for traction, an increase in the units sold of 10,550,763 units. The average price obtained per unit was 1·29d., as against 1·16d. in the previous year; total motor connections, 131,912 h.p.

Brierfield.—Price Increase.—In pursuance of its agreement with the Nelson Corporation, the U.D.C. has resolved to increase its charges for the supply of electricity for lighting and power to the prices charged at Nelson.

Burton-on-Trent.—Year's Working.—During the past year the Corporation electricity undertaking earned a total revenue of £27,203; working expenses amounted to £15,692, and after deducting loan charges, £6,474, contributions to capital expenditure, £1,013, and special expenditure (including £221 bonus under the profit-sharing scheme), £709, there is a surplus on the year's working of £3,313, which, with £663 transferred from the renewals fund, it is proposed to allocate as follows:—£3,063 for the new mains to the rubber works at Horninglow and £913 for mains extensions services and transformers. The total number of units sold during the year amounted to 4,394,969, an increase of 401,772, or 10·06 per cent. as compared with 1916-17. Power supply showed an increase of 368,212 units. The total average works cost was ·857d., as against ·728d. in 1917, and the total costs 1·304d., as against 1·259d. in the previous year.

Cleckheaton.—Accident.—Through the bursting of a steel band on the armature of a generating set at the electricity works, on Tuesday, June 11th, the whole of the plant was shut down for 24 hours, no duplicate part being available; the other three sets had to be dismantled in order to effect the necessary repairs.

Colchester.—The T.C. has decided to give the Secretary of State for War a year's notice to terminate the present agreement for the supply of energy from July 1st. The Council has asked the War Office to pay an additional 10 per cent.

Continental.—Denmark.—Hydro-Electric Scheme.—A scheme for the utilisation of the water power in the Gudenaa, in Jutland, has, reports H.M. Minister at Copenhagen, passed the first reading in the Danish Landthing, and has been sent to Committee for consideration. It is proposed to construct a dam across the valley of the River Guden below the junction with the Tange, and deepen the bed of the river from Bjerringbro to Tange, so that a fall of about 9 metres can be obtained. It is expected that 600,000,000 cb. metres of water per annum can be obtained; this will produce 15,000,000 effective h.p. units, or 10,000,000 kw. per annum, of which, it is estimated, only about 8,000,000 kw. will be utilised. The cost of the undertaking is estimated at about £225,000, and, provided the materials for construction are obtainable, the work could be completed within one and a half years. The present difficulties experienced in producing light and power by the employment of coal have made the question one of considerable importance to the districts concerned. In spite of the increased cost of material, it is thought that by means of the new power station it will be possible to produce electricity at a much cheaper rate than is the case at present, and that the whole of central Jutland will benefit by it. It is pointed out that the scheme will enable Denmark to obtain power and light without being dependent on raw materials from abroad.—*Board of Trade Journal.*

Sweden.—The Bergsjo Kraft Aktiebolag is the name of a new undertaking that has lately been formed at Bergsjo, Sweden, with minimum and maximum capitals of £7,200 and £14.000 respectively, to establish a small hydro-electric generating station for the supply of energy for lighting and power purposes.

Spain.—Our correspondent in Spain sends the following :—*New Transmission Lines:* The Sociedad Minera y Metalurgica de Penarroya is installing three new lines as follows :—

1. An overhead line of 70,000 volts from the generating station of Pueblonuevo del Terrible to Villanueva de Cordoba. This will connect the Penarroya central station with the hydro-electric installations in Linares, owned by the Mengamor Co. This line is now completed.
2. An overhead line of 30,000 volts from the generating station of Pueblonuevo del Terrible to the City of Cordoba, composed of two sections. The first section (Puebloneuvo del Terrible to La Ballista) is already installed, and the second section (La Ballista to Cordoba) is just started. This line is to supply electricity to the City of Cordoba and to the newly-founded Sociedad Espanola de Construcciones Electro-Mecanicas.
3. Three lines from Espiel to the Restamada and Candelaria Mines and to the coal briquetting plant recently installed by the Penarroya Co.

The Gijon Electricity Co. has been granted permission to run a high-tension line from Avilés to the Port of San Juan de Nieva, a distance of about 40 miles.

Crewe.—Price Increase.—The Corporation has decided that the present charges for electricity be increased by 12½ per cent. as from next month. There is a deficiency on the electricity undertaking of £644.

Dublin.—Loan Application.—Mr. P. C. Cowan, Chief Engineering Inspector, Irish Local Government Board, held an inquiry, last week, into an application of the Corporation for sanction to a loan of a sum of £175,000 for the purpose of carrying out extensions to the electricity undertaking. At the outset the inspector remarked that the Corporation did not say from whom it proposed to borrow the money if sanction were given. Mr. S. Orr, on behalf of the Citizens' Association, asked that the loan should stand postponed until it was definitely known what action, if any, the Government proposed to take in the national scheme of generation and distribution of electric power. In the alternative, he urged that, unless a case of extreme necessity was established, no loan for even a partial replacement of the present plant by new plant should be sanctioned ; that if a case for renewal of plant was shown, it should be considered whether the cost of such renewal should not come out of revenue ; that as the proposed loan would bring the municipal debt to above £3,000,000, it should not be sanctioned unless it was clearly established that a reduction in the city's abnormally heavy rate burden would be the outcome ; and that the expenditure on the proposed extensions and the tunnel under the River Liffey should not be sanctioned unless direct and conclusive evidence was forthcoming of the immediate establishment of new industrial factories in the harbour district.

For the Corporation, Mr. Philip White said the loan was divided into three sections—£60.000, £50,000, and £65.000. Of the former, £25,000 was wanted for boilers and plant and £35,000 for engines and dynamos. Of the £50,000, £15,000 was for the tunnel construction and £35,000 for cables, sub-station, and contingencies ; and the £65,000 was for distribution work. The existing plant demanded a great deal of attention. Last year the demand for power and light was such that there was little chance of carrying out repairs ; they now wanted some plant they could fall back upon. Mr. H. Campbell, town clerk, said that extension of the electricity works could not be further postponed. He understood the War Office authorities were going to take electric power at the North Wall from the Dublin United Tramways Co. over the heads of the Corporation—the sole body, he contended, that had statutory right to supply it.

The Inspector read a letter from Dublin Castle to the Local Government Board, in which it was stated that the War Office had decided that the power required for hydraulic hay-presses at Alexandra Dock should be obtained from the Port and Docks Board's electric installation, supplemented by a stand-by connection to the Port and Docks Board's mains from the Tramways Co.'s power station at Ringsend. As both the Board and the company were prohibited by Act of Parliament from supplying energy otherwise than for their own purposes, it was intended to issue orders under the Defence of the Realm Act for the supply of the power. The Corporation was at present unable to give a supply at North Wall, and could not do so in time for the War Office requirements. The Inspector said the War Office requirement in the matter was urgent, but only temporary. and the right of the Corporation would not be affected in any way. Evidence of the Corporation's borrowing powers was then given by Mr. H. Morgan, the city accountant.

Dewsbury.—Owing to the probable shortage of coal, the Electricity Committee has notified all consumers that no new work should be started, or apparatus bought, without sanction being first obtained from the Committee.

Faversham.—Reduced Consumption.—The electrical engineer has reported to the T.C. that the return of electricity consumption for May shows a reduction of only 2·9 per cent., whereas the Restriction Order requires a reduction of about 20 per cent. It was explained that some allowances had to be made for new customers. It was decided to apply for exemption from the Order in the case of the sewage pumping station, which must be kept running.

Fife.—Mains Extension.—Arrangements are being made for the laying of a cable from Crossgates to Burntisland, to supply power for the shipyard at Burntisland, and other industrial purposes.

Harrogate.—Price Increase.—The T.C. has decided to advance the price of energy for lighting by another 15 per cent., making a total increase during the war of 25 per cent.

Kettering.—Year's Working.—Annual Accounts.—The report of the year's working of the U.D.C. electricity undertaking to March 31st shows total revenue £22,815 ; working expenses, £15,585 ; gross profit, £7,230. Interest and sinking fund charges amounted to £6,137, leaving a balance on the year's working of £1,093, which with £4,275, balance from last year's account, and £45, in all £5,413, has been carried forward to next account. Total units sold, 2,718,585 ; total maximum demand, 1,496 kw.

Slaithwaite.—The B. of T. has extended the electric lighting order for a year from July, 1918.

Sleaford.—Price Increase.—The U.D.C. has decided to increase the price of electricity by ½d. for all purposes, the increase being approximately 10 per cent.

Sunderland.—Year's Working.—The annual report of the electricity department shows an increase in the amount of electricity sold, by comparison with the preceding year, of 14 per cent. in power supplies, 0·3 per cent. in lighting and heating, and 0·6 per cent. in traction. The load factor was 26·72 per cent., as against 26·53, and the maximum load was 7,400 kw., as against 6,700 ; units sold were 17·32, against 15·61 in the previous year. The report states that the new 7,500-kw. turbo-generator was not available, but every effort was being made to get it into commission before the winter. The Committee had decided to erect a new cooling tower and install larger boiler-house plant. The accounts show a revenue of £85,324, and, after meeting expenditure, there was a balance of £34,124. This balance, after payment of £10,513 for interest on capital, &c., was reduced to £22,431, appropriated as follows :—Repayment of loans, £17,816 ; redemption of lands, £120 16s. ; superseded plant, £3,826 ; and £668 depreciation of stock.

Walsall.—The Town Council has decided to extend the supply mains, at a cost of £4,200, to give a supply of current to the Holly Bank Colliery Co.

Warrington.—Price Increase.—The T.C. has increased the charges for energy for all purposes other than tramways, by 10 per cent., as from the end of June.

TRAMWAY AND RAILWAY NOTES.

Bradford.—Result of Fare Increase.—The increase of 50 per cent. in the tram fares has so far been successful. The manager of the tramways department (Mr. C. J. Spencer) stated to the Committee, last week, that the receipts for the first nine days under the increased charges had been £13.099, as compared with £9,906 for the corresponding period of last year. This represented an increase of 32 per cent., whereas the official estimate was 30 per cent. when the increase was decided upon. It is understood that the number of passengers had been considerably reduced. and the shorter queues have been very noticeable.

The Tramway Committee has decided to make a reduction in the number of stopping places on the various routes of the system.

Brighton.—Year's Working.—The Corporation tramways accounts show a surplus of over £15,000. Nearly 17,000,000 passengers were carried during the year.

Canada.—Wage Increase.—As a result of negotiations Montreal Tramways employés have been given increases of wages averaging 20 per cent.—*The Times.*

With a view to conserving fuel, the Montreal Light, Heat, and Power Co. has entered into an agreement to supply the Montreal Tramways Co. with additional hydro-electric power, thus restricting the use of coal for the tramway company's steam plant ; the arrangement will continue for 18 months, and is estimated to save about 37,000 tons of coal. The tramways company is supplied with a certain amount of power under agreement by the Montreal Light and Heat Co., but the peak load at the busy hours is taken by the tramway company's steam plants, a new plant having been recently installed. The new agreement is likely to call for at least 10,000 h.p. per annum.—*Canadian Electrical News.*

Dover.—Women Drivers.—Women drivers are to be employed on the Corporation electric tramways, and are to be paid the same rate of wages as the men.

London.—Sunday Service.—Commencing on Sunday morning, June 16th, the Sunday through services between the L.C.C. and the Metropolitan Electric Tramways were resumed. The suspension of these services during the past few weeks caused considerable inconvenience to workers.

New Zealand.—Electric Vehicles.—According to the *Board of Trade Journal*, the Christchurch city authorities propose to lay themselves out to encourage the use of electric vehicles. At present they have a charging station attached to their works in which they receive electric cars overnight, keeping them in order and garaging them, for the sum of £26 a year. The cars are charged at night, or as opportunity offers, and payment for current is assessed according to the amount taken. At a later date, when power is available, it is proposed to have charging stations at various points throughout the province, and it is expected that when these arrangements are made a big business will be done with electric vehicles for use throughout all the country districts. At present these vehicles are used practically solely within the town radius. One large firm has stated, that it would not pay them to use petrol wagons as against electric wagons, even if the petrol wagons themselves were supplied free of charge at the beginning. The use of these vehicles may also spread in other districts of New Zealand, not because of their efficiency, but because of the high price of petrol.

Otley.—Protest against Increased Fares.—The District Council has raised a strong protest against the Leeds Corporation's increased fares between Guiseley and Otley (a trackless system), and it was pointed out that this was in direct contravention of the understanding come to on March 9th, 1914, by which it was laid down that the fare for that distance should not exceed 3d. There was not, it was contended, as much wear and tear on a trackless system as there was on rail systems. The matter has been referred to the clerk, and the local Tramways Committee.

Wigan.—Strike.—Last week the employés of the Corporation tramways threatened to hand in their notices unless the Committee agreed to six inspectors and a cash clerk, who had seceded from the National Society of Municipal Officers, joining the Vehicle and Tramway Workers' Union. Sir George Askwith asked the Committee to submit the matter for arbitration, so that the traffic should not be dislocated, and the Committee agreed to this course. On Saturday at noon, however, the drivers struck work, in defiance of the advice from headquarters to continue pending the arbitration. This is the second time during the war that the tramway employés have struck work contrary to the advice of their Union officials.

The employés, after an interview between Mr. Bradwell, the Union secretary, and the Corporation management, agreed to resume work on Monday, June 17th, pending the decision of Sir George Askwith on the matter in dispute.

TELEGRAPH AND TELEPHONE NOTES.

Breaking Insulators.—For wilfully breaking telegraph insulators, three small boys from Highfields were summoned at Doncaster, last week, and fined 20s. each, all three having previously been before the Court. They had broken 20 or 30 insulators, one of them acknowledging to breaking 11 with a catapult.

The Imperial Wireless System.—Replying in the House of Commons, last week, to Sir John Butcher, who asked whether reasons could be given why the Marconi contract for the erection of wireless stations had been repudiated by the then Postmaster-General, Mr. Illingworth (Postmaster-General) said that in January, 1915, the then Postmaster-General informed the Marconi Co. that the principal reason which had actuated the Government in arriving at the decision in question was the altered circumstances resulting from the war, and especially from the prospect that hostilities might be prolonged. He stated that, in the opinion of the Government, the present and prospective naval and military requirements, which were the governing factors in determining the scheme for the Imperial wireless chain, could be better met by means other than the construction of stations of the character, and in the situations, contemplated by the contract.—*Birmingham Daily Post.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Lancaster. — July 16th. Electricity Committee. 6, 9, and 12 months' supply of slack or nuts (screened and washed). Mr. J. B. Patterson, Electricity Works, Marton Street.

London. — Fulham. — July 10th. Borough Council. Cables, ducts and accessories for the linking-up of the Fulham and Hammersmith Electricity Works. See "Official Notices" to-day.

Manchester.—June 26th. Work in connection with the widening of coal railway between Stuart Street and the Ashton Canal for the Electricity Committee :—(*a*) General contractors' work. (*b*) Steelwork in bridge over Stuart Street. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Morecambe.—Electric Light Committee. 2,000 tons of rough slack. See "Official Notices" to-day.

CLOSED.

Australia.—Eugene F. Phillips Electrical Works, Ltd., Montreal, have received an order from the Postmaster-General's Department of the Australian Commonwealth for about a million feet of paper-insulated lead-covered telephone cable. This is believed to be the first order from this source which has been placed in Canada. The company have also received an order for paper-insulated lead-covered double-steel tape-armoured telephone cable from the Union Government of South Africa.—*Canadian Electrical News.*

Poplar.—Electricity Committee. Tenders recommended :

Chain grate stokers.—Underfeed Stoker Co., £2,287.
E.H.T. and L.T. cable. Pirelli, Ltd., £2,698.
L.T. cable.—Western Electric Co., Ltd., £3,305.

Stepney.—The Electricity Committee has accepted the offers of Messrs. E. Foster & Co. for 9,400 tons of coal, at from 23s. 5d. to 31s. 11d. per ton.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Friday, June 21st. At the Town Hall, Manchester. At 9.30 a.m. Council meeting. Resumed discussion on "Electric Power Supply." Annual general meeting.

Junior Institution of Engineers.—Thursday, June 27th. At 3 p.m. Visit to the Gnome & Le Rhone Engine Works (Messrs. Peter Hooker, Ltd.,) Blackhorse Lane, Walthamstow.

Friday, June 21st. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "The Heating of Industrial Buildings," by Mr. M. H. Jones.

Monday, June 24th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Lecture on "The Stokes Gun," by Sir Wilfrid Stokes.

Physical Society of London.—Friday, June 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. General meeting.

NOTES.

Foreign Trade.—The May Figures. — The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	May, 1918.	*Inc. or dec.*	5 *months,* 1918. *Inc. or dec.*
Imports.			
Electrical goods ...	81,129	− 18,645	− 225,792
Machinery	990,717	+202,338	+ 1,109,617
Exports.			
Electrical goods ...	375,001	+137,903	− 480,117
Machinery	1,694,822	− 462	− 1,914,882

Notes from Spain.—Our correspondent in Spain sends the following :—

Olive Oil for Diesel Engines.—The Triana central station, in Melilla (Morocco), has been shut down several times during the past three years for lack of mineral oil for its Diesel engines. Some recent experiments with olive oil proved that olive oil alone is not suitable for the Diesels installed at Melilla, but a mixture of two parts olive and one part mineral oil (petroleum) gave excellent results. Unfortunately, the difficulty in obtaining petroleum is still acute, and further experiments are being made with vegetable oils.

In this connection it is interesting to note that the Spanish Government has just awakened to the fact that no petroleum has arrived in Spain for about a year. As a remedy, the Spanish Consul at Tampico (Mexico) points out that several small oil wells in Mexico are in the hands of Mexicans, and their product is therefore available in Spain and other neutral countries, if only transport can be supplied.

A New Spanish Industry.—A French company has acquired some important waterfalls at Esera and Cinca (Aragon), and will shortly erect hydro-electric plants for the manufacture of fertilisers.—*Heraldo de Aragon.*

Hydro-electric Development.—The Valencia Chamber of Commerce has opened a public inquiry respecting the benefits which would accrue to the Valencia region through the utilisation of a waterfall on the river Jucar, in the Province of Albacete. From this fall 6,398 H.P. could be transported to Valencia.

A great number of applications for water-power concessions have recently been presented from all parts of the kingdom, ranging from 3,620 H.P. (town of Alloz, Navarra), to 20 H.P. (Salas de los Infantes, Burgos). The smaller units required will be supplied by Spanish manufacturers, while the larger ones, water turbines and alternators, will probably come from Switzerland. An additional Escher Wyss-Brown-Boveri set of 1,500-K.V.A. capacity has just been installed by the Sociedad General Gallega de Electricidad.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 25 by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Hynam.

Next for Duty.—Capt. W. Darley Bentley.

Sunday, June 23rd.—Commandant's Parade at Waterloo Station, 8.45 a.m. Work. Revetments at Heywood. Dress Service dress, drill order, haversacks, and water bottles. Mid-day and tea rations to be carried.

Monday, June 24th, to Friday, June 31st.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Constantinople Tramway and Electricity Undertakings.—Some information has just become available respecting the transport and supply undertakings at Constantinople during the war. It may be remembered that various financial groups in Belgium, France, Germany, Hungary, and Switzerland formed in the course of the year 1911 a working community under the title of the Consortium de Constantinople, for the purpose of combining the transport and electricity undertakings in the Turkish capital under a central administration. The Consortium acquired most of the capital in the Constantinople Tramway Co., and the whole of the capital in the Galata-Pera Rope Railway, and also concluded a working agreement with the Belgo-Hungarian group, who held the capital in the Société Ottomane d'Electricité and the Stamboul Gas Co. The Consortium next embarked upon the conversion to electric traction of the then existing tramway system, and sought to secure concessions for the construction of additional tramways and for an underground railway of a length of about 4·3 miles, which was to connect Stamboul with Galata and Pera by means of a tunnel under the Golden Horn. The concession for the latter was granted in 1912, and the preliminary survey was made, but the execution of the scheme has been postponed in consequence of the war. In August, 1913, electrical working was inaugurated on one tramway, and this has since been extended to the other tramlines. The Société Ottomane d'Electricité, in the meantime, had built a new generating station, which was opened in March, 1914. Three months later—June, 1914—the Société de Tramways et d'Electricité de Constantinople was formed in Brussels, with a share capital of £720,000, for taking over all the interests of the Consortium in Constantinople, and this transfer is reported to have been sanctioned in November, 1916. The working receipts of the various undertakings since 1914, according to information published in German newspapers, has been as follows in Turkish £:—

	Receipts in			
	1914.	1915.	1916.	1917.
	£T.	£T.	£T.	£T.
Tramways ..	189,494	232,067	285,600	342,177
Galata-Pera Railway	42,560	42,947	38,989	54,074
Electricity works (receipts)	31,117	70,939	137,509	222,730
Electricity works (supply in kw.-hours)	5,816,355	9,968,550	14,818,900	21,443,003

The above figures show that the revenue earned by the tramways and the electricity works has constantly increased despite the difficulties caused by the war, particularly in the dearness of raw materials and of labour. Nevertheless, it is stated that the tramway company has been able to pay a dividend of 5 per cent. in each of the past four years, and the Galata-Pera Co. distributed 11 per cent. for 1916, and is expected to pay 10 per cent. for last year. On the other hand, the electricity supply company, which has to cope with the greatest difficulties on account of the scarcity of coal and other raw materials, will probably record a loss on working in 1917. The company had 16,821 customers at the end of 1917, representing a connection of 13,878 kw., as compared with 10,838 kw. at the close of 1916.

The Société de Tramways et Electricité de Constantinople is reported to have acquired in July, 1916, the whole of the share capital in the Stamboul Gas Co., which had suspended the production of gas at the beginning of 1916 owing to the lack of coal. The former, whose financial year ends on June 30th, is stated to have paid 4½ per cent. in 1914-15 and 1915-16, whilst the profits obtained in 1916-17 have been applied to depreciation.

Conciliation and Arbitration.—The Whitley Committee on the Relations between Employers and Employed have presented a further report, which is now published by Dr. Addison, Minister of Reconstruction. It deals with conciliation and arbitration. The Committee pronounce definitely against any system of compulsory arbitration, on the grounds that it is not generally desired by employers and employed, that it has not proved a successful method of avoiding strikes during the war, and that it would be less likely to be successful in time of peace. They also pronounce against any scheme of conciliation which would compulsorily suspend a strike or lock-out pending an inquiry. The Committee advocate the continuance, however, of the present machinery for voluntary conciliation and arbitration, and hope that the setting up of Joint Industrial Councils (on the lines recommended in their earlier reports) will tend to the growth of such machinery. They consider that there should be means for holding independent inquiry into the circumstances of a dispute and for making an authoritative pronouncement thereon without the compulsory power of delaying the strike or lock-out. Their main constructive suggestion is that a Standing Arbitration Council should be established on the lines of the present temporary Committee on Production. To this Council disputants would be able voluntarily to refer such differences as they are themselves unable to settle. It is suggested, however, that single arbitrators should be available for less important cases, which could be heard locally. It is further suggested that the Standing Arbitration Council should take means to secure the co-ordination of arbitrators' decisions. The Committee are opposed to the enforcement of awards and agreements by means of monetary penalties. The report is available from H.M. Stationery Office, Imperial House, Kingsway, W.C. 2, price 1d.

The Canadian Fuel Situation.—In the April 15th issue of the *Electrical News* there are reproduced a number of papers dealing with the fuel situation, and more particularly the relation between electricity and the relief of the fuel shortage, presented before the recent professional convention of the Canadian Society of Civil Engineers, held in Toronto. Although there may have been no great amount of new information brought forward in those papers, yet the conference was notable, in that it indicated the interest professional engineers were taking in the situation, and showed that they were in possession of all the knowledge necessary to supply a solution of the difficulties under which they had laboured during the past winter.

The conference, unfortunately, was not able to prove that electricity can compete, in dollars and cents, with coal as a source of heat supply. There is not sufficient electric energy available to supply the general needs of Canada. Immediate relief, therefore, must come from some other source, and in this respect wood was recommended as the most easily available, and, after that, peat: the latter fuel, however, could not be available until the winter of 1919. It was pointed out that water power must take a very prominent part if the best use of the varied fuel resources of Canada was to be achieved.

The conference was also of interest in that considerable light was thrown upon the possibilities of general electrification of railways. It was shown that while this was an end to be worked for, there was no immediate prospect that the coal situation could be relieved during the next two or three years by electrifying the railways of the Province of Ontario in any except isolated cases. When conditions arrived rendering such electrification possible, the fuel saving would be very great. The papers constitute a record of information which will be found of great value.

Water Powers in Europe and North America.

Country.	Population.	H.P. available.	H.P. developed.	Per cent utilised
U.S.A.	98,783,300	28,100,000	7,000,000	24·9
*Canada "A"	8,033,500	18,803,000	1,735,000	9·2
†Canada "B," populated	8,000,000	8,094,000	1,725,000	21·3
Austria-Hungary ...	51,173,800	6,460,000	566,000	8·8
France	39,601,500	5,587,000	1,100,000	11·6
Norway	2,391,780	5,500,000	1,120,000	20·4
Spain	19,588,700	5,000,000	440,000	8·8
Sweden	5,522,400	4,500,000	704,500	15·6
Italy	28,601,000	4,000,000	976,300	24·4
Switzerland	3,781,500	2,000,000	511,000	25·5
Germany	64,926,000	1,425,000	618,100	43·4
Great Britain	40,831,400	963,000	80,000	8·3

* "A" excludes Yukon and Northern Area improbable of immediate development. † "B" included in "A" is area actually settled.

"Safety First" in Industry.—Lord Leverhulme, presiding at a Mansion House conference, last week, to inaugurate a national industrial "safety first" campaign, said that in Germany £50,000,000 was saved in industry every year by attention to "safety first" appliances. The object of the new movement was to ensure that we should have throughout the United Kingdom such a condition of "safety first" as would give us the equipment for winning the industrial war after we had won the military war.

Mr. W. Hayes Fisher, President of the Local Government Board, welcomed the movement, to which he promised to give every assistance. They must use education to make people see that it was their duty to themselves, to their families, and to the State, to take every possible precaution to preserve their lives.

Mr. G. H. Roberts, Minister of Labour, said that no works should be tolerated in the country unless they were sanitary and properly lighted, and the machinery was safeguarded. Then they would be entitled to expect the workers to take every care to avoid accidents and disease. They must insist upon certain standards of equipment in the various works and factories, and in this matter he promised the support of his Department.

Mr. W. Brace, Under-Secretary for the Home Department, wished the movement every success, and assured the promoters of the co-operation of the Home Office.—*The Times.*

Industrial Councils at Birmingham.—Steps are being taken to establish Whitley Industrial Councils in relation to Birmingham municipal employés. A meeting of the Salaries, Wages, and Labour Committee was held on Tuesday, and this was attended by the chief officials of the Corporation to give their views as to the way in which such Councils might be formed. It was stated that the general question of the formation of such Councils was receiving the attention of the Association of Municipal Corporations. The Birmingham Committee came to no definite decision.

Dirt in Coal.—Sir Albert Stanley, in a written reply to Brigadier-General Page Croft, states that the Controller of Coal Mines is fully alive to the significance of the increased percentage of separable dirt in coal, and is sparing no effort to decrease it. The importance of the matter has been impressed both on miners and the management of collieries by letter, and in some cases by addressing mass meetings. An officer of special experience has been appointed to make investigations at collieries with regard to specific complaints, and to consult with both the management and the workmen regarding the steps to be taken to remedy the trouble. In so far as the percentage of separable dirt is affected by the cleaning and picking of the coal on the surface, the increase is partly due to the scarcity of labour and machinery necessary for that purpose.—*The Times.*

The Future of Gas and Electricity.—In the course of his presidential address to the Institution of Gas Engineers, on June 4th, Lord Moulton said that he was in entire agreement with the view that existing illuminating standards should be abolished, and a reasonable calorific value (preferably uniform throughout the kingdom) be put in their place as to the standard to which gas should conform. It would thus be possible to increase the amount of gas obtainable from the coal employed, and various coal-tar products need no longer be destroyed by being burnt with the gas. This introduction of a universal calorific standard for gas should take place without delay. It would put gas and its great rival, electricity, on an even footing in one important respect. Each would be paid for in proportion to the amount of energy supplied to the consumer—in the one case in the form of thermal units, in the other in the form of electrical units. They would have as their confessed object the supply of a like public want, though by wholly different means. It was, in his eyes, an industrial mistake to aim at making either displace the other. But in order that the public might reap the full benefit of the two, each must be free to do its work in the best way it could, using all the advantages it possessed, both in respect of production and consumption, unhampered by needless or harmful restrictions. The capacities of electricity for concentrated production and wide distribution had been demonstrated, and were being industrially utilised far and near. Schemes of distribution of electricity of the most ambitious and far-reaching character were now being treated as a part of practical politics. They must look forward in the near future to a strengthening and consolidation of electrical distribution so far as it could safely be effected, and in this development it would most probably receive support from public funds, and would certainly be assisted by largely-extended statutory powers. Thus favoured, electricity would be in a position to offer a fiercer competition with gas companies in the domain of public lighting. And this furnished, to his mind, a strong justification for the demand that there should at once be a revision of their statutory obligations.

Electrical Power Engineers' Association.—The first meeting of the Liverpool Branch was held on Friday last. Mr. F. E. Spencer (Birkenhead) was elected chairman, and Mr. J. Hamilton (88, Routelet Road, Stoneycroft, Liverpool), hon. branch secretary, with a Committee of five. Application forms for membership from engineers in the Liverpool district may be had from the secretary.

Fatality.—A verdict of "Accidental death" was returned at West Bromwich upon W. C. Baker (19), who died from injuries received at Oldbury Carriage Works. He was engaged in fixing electric wires to a stanchion, when he was struck by an electric crane.

Coal Rations for Industries.—It is understood that the Coal Controller contemplates rationing coal to industries as well as to householders. A Conference on the subject will be held in the next few days.—*The Times*.

"Self-Delivery" of Electric Vehicles.—Electric vehicle manufacturers in the U.S.A., confronted with freight transportation congestion, have resorted to the method of "self-delivery" (under their own power) of their cars. Many such deliveries from factories to agencies have been made, as evidenced by the following account of a standard electric passenger car, in travelling over 80 miles of snow-drifted roads. Mr. H. H. Dennis, who drove the "electric" from Toledo to Detroit, demonstrated the ability of the vehicle to negotiate roads that blocked the progress of motor trucks, and which drivers of high-powered gasoline cars would not attempt for fear of being stalled. The trip was made the day following a 6-in. fall of snow, that drifted before a high wind and blotted out the beaten track, making it very easy to get into snow banks 3 and 4 ft. deep.

Four miles out of Monroe, two Government trucks that were hauling crushed stone were met; they had got out of the road and were stalled. Mr. Dennis took the "electric" into the deep snow at the side to get past them. A little further along the way he met face to face an Army truck train en route to the coast. One of the Army trucks had turned out to let another car go by and was stalled. The officer had issued orders not to turn out again for any other vehicle. This forced the "electric" to go down in a ditch along the roadway and travel in the deep drifts there, till 19 Army trucks were passed. A few miles further on more Government trucks were met. They also were stalled, and this time the "electric" plunged through a 3-ft. drift to go by. The truck drivers cheered as the "electric" turned back into the beaten track. Near Detroit, Mr. Dennis passed between 25 and 30 new cars which he gave a wide berth, deliberately taking the side of the road and forging through the drifts.

Not once did the "electric" falter; and while the charge of the batteries was practically exhausted when the car rolled into the service station in Detroit, it made the distance without trouble. To travel 80 miles in an "electric," which has been in service some time, is a fair average trip for a single charge, even under good road conditions. With deep snow and numberless turn-outs, it stands as a very good record.

Training Disabled Soldiers.—Mr. Hodge, Minister of Pensions, replying to Mr. Anderson, in the House of Commons, said:—The number of medical cases which were receiving training in the week ended June 5th, and the number which had received training under the Ministry up to that date, were 6,526 and 7,613 respectively, or a total of 14,139. In practically every case men who have completed courses of training had been put into employment.—*The Times*.

The Engineering Trades After the War.—The complete reports of the B. of T. Committees on the engineering and iron and steel industries have now been published. We hope to refer to their contents later.

Platinum from Russia.—Many of the delicate electric instruments essential to war machinery depend upon platinum for special parts. In this connection it is interesting to learn from the *Journal of Electricity* that Russia's supply of platinum is being entirely taken over by Germany. There are only between 25,000 to 50,000 oz. of the precious metal in the United States to-day, and Nevada, California, Utah, and Oregon have turned out not more than 750 oz. a year, which geologists believe can be increased to 3,000 oz.

Radio Instruments and Measurements. — The U.S. Bureau of Standards has issued a treatise on radio measurements, which includes a development of the essential theory of high-frequency measurements from simple but precise low-frequency theory, the use of reactance curves in the rapid solution of problems, descriptions of radio instruments, and formulæ and data for radio work. The full treatment of fundamental principles will make this circular serve as a foundation for later publications which may be issued by the Bureau on the general subject of radio communication.—*Journal* of the Franklin Institute.

Institution and Lecture Notes.—**Institution of Municipal Engineers.**—Mr. Reginald Brown, M.Inst.C.E., engineer and surveyor, Southall-Norwood U.D.C., has been nominated as president of this Institution. The following notice of motion has been given:—

> That it is desirable, in the opinion of this Institution, that municipal engineers should be represented by one strong body, and with this object in view the Institution of Municipal and County Engineers be asked to appoint three of the members of their Council to meet three members of the Council of this Institution to discuss the matter, and to report later to their respective Councils.

Appointments Vacant.—The Keighley Tramways and Electricity Committee is asking for authority to appoint an assistant electrical engineer and tramways manager, at £200; a junior shift engineer, electrical mechanic, is wanted for the Rotherham Corporation Electricity Supply; shift engineer (60s. + 12½ per cent.), junior assistant engineer (38s. + 12½ per cent.) for the Rawtenstall Electricity Department; electrical draughtsman for the Admiralty Department of Electrical Engineering; engineer-in-charge (£175) for the Darlington Corporation Electricity Works; shift engineer for the Stepney B.C. Electricity Department; meter superintendent (63s. + 12½ per cent.) for Loughborough Corporation Electricity Works. See "Official Notices" to-day.

The Periscope in a Power House.—The periscope is now being used in the deadly wilds of the power plant. In order to read the temperature of the oil in transformers in a Western plant, it has been necessary in the past to use a step-ladder to reach the thermometer mounted at the top of each unit. By using a simple periscope on each transformer, it is now possible for the attendants to read the thermometer scale from the floor.

Industrial Reconstruction Council.—This Council has issued a manifesto concerning Capital and Labour and the Government, in which it presses for the immediate acceptance of the following principle:—That any commercial or industrial matter ought not to interest the Government unless it interests both Labour and Capital. It urges the consequent adoption of the following policy:—That the Government will undertake to obtain, and, wherever possible, accept, advice on these matters from bodies equally representative of both Labour and Capital.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the St. Pancras Borough Council generating station, King's Road, MR. W. J. LEE, A.M.I.E.E., engineer-in-charge, was presented with a service of cutlery by the staff and employés on the occasion of his marriage to Miss Edith Maud, of Leigh-on-Sea.

The proposal to rescind a resolution of the Hackney Borough Council, dated March, 1906, fixing the salary of the borough electrical engineer at £750, not having been carried, the recommendation for increasing the maximum to £1,000, already mentioned here, has been dropped.

The Stafford Council has increased the salary of MR. W. H. ROBINS, electrical engineer, by £20 per annum.

Ashton-under-Lyne Town Council has decided to increase the salary of MR. NEVILLE APPELBEE, borough electrical engineer, from £500 to £550 per year, as from October last. Ald. Coop, chairman of the Electricity Committee, pointed out that in July, 1914, the Committee passed a resolution in favour of the salary being increased by £100, but at the August meeting, on the outbreak of war, the resolution was withdrawn.

The salaries of the Bradford City electrical engineer (Mr. Thomas Roles) and his deputy (Mr. J. H. Shaw) have been increased by £100 each. By these increases the respective salaries of the two gentlemen amount to £1,000 and £550 respectively. The recommendation of the Electricity Committee was for £200, but the War Wages Committee overruled that figure, and recommended £100.

The Torquay Electricity Committee proposes to increase the salary of Mr. Williams, the collector, from £150 to £160 per annum, the war bonus of 10 per cent. thus automatically ceasing.

Mr. R. C. Hill, who was engineer-in-charge at the Gloucester Corporation Electricity Department, has been appointed Assistant Motor Engineer (Officer), in the Royal Fleet Auxiliary Service, Salvage Section.

General.—Mr. R. W. Willis, A.M.I.E.E., electrical engineer on the staff of the Director of Electrical Engineering, Admiralty, has been appointed to represent the Director in Manchester in regard to work in progress in the north-west area of England.

The Hon. Sir Charles A. Parsons, F.R.S., &c., has consented to fill the office of President of the Polytechnic School of Engineering, Regent Street, W., in succession to the late Mr. Charles Hawksley. The first president of the school was Prof. David Hughes, F.R.S., the founder of the Hughes Medal of the Royal Society.

Colonel J. J. Carty, U.S. Signal Corps, and chief engineer of the American Telephone and Telegraph Co., was presented with the Edison Medal in recognition of his services in developing the science and art of telephone engineering, at the annual meeting of the American Institute of Electrical Engineers, in New York, on May 15th.

The Institution of Mining Engineers has expelled Mr. Arnold Lupton from its membership.

Mr. E. Kilburn Scott, who has been in the United States for some months on business, has delivered lectures before various audiences on the manufacture of nitrates from the air. He recently addressed a meeting of the Yale Branch of the American Institute of Electrical Engineers at the Sheffield Scientific School of Yale University, and stated that the Germans, who were entirely dependent on their own resources for fixed nitrogen, must be making it for explosives and fertilisers at the rate of over a million tons a year.

Mr. Malcolm Leggett, F.C.I.S., has resigned his position as secretary of Pritchett & Gold and Electrical Power Storage Co., Ltd. Communications should be addressed to him, care of the Chartered Institute of Secretaries, 59a, London Wall, E.C. 2. Mr. Leggett was secretary of the Electrical Power Storage Co. for several years until its amalgamation with Pritchetts & Gold, Ltd., in 1915.

A peerage has been conferred upon Sir Wm. Weir, Secretary of State for the Air Force, who is a member of the well-known Glasgow engineering firm of G. & J. Weir, Ltd.

Alderman Ellaway has been appointed chairman of the Birmingham Tramways Committee, in succession to Mr. Harrison Barrow, who recently resigned his public work.

Mr. H. M. Schofield, of the secretarial department, County of London Electric Supply Co., has received his commission as a full flying officer in the R.A.F.

Roll of Honour.—Gunner G. F. Willott, R.G.A., of the secretarial department, County of London Electric Supply Co., Ltd., has been killed in action in France.

Sergeant H. W. Weymouth, R.F.A., formerly employed at Messrs. Siemens Bros. Dynamo Works, Stafford, has been awarded the Military Medal for gallantry and devotion to duty on May 15th.

Private Andrew Kay, Royal Welsh Fusiliers, killed in action, was formerly employed at the British Westinghouse Co., Ltd., Trafford Park.

Private H. Allen, London Regt., for some years on the staff of the Croydon tramways, is a prisoner of war in Germany.

Private H. Burke, Lincs. Regt., who is reported missing since March 21st, was engaged with Wright & Wood electrical engineers, of Halifax.

Private H. Saville, K.O.Y.L.J., reported wounded, was on the staff of the Wakefield Electricity Works.

Second-Lieut. A. J. Crawford, Tank Corps, an apprentice at the British Westinghouse Works at Manchester, has been wounded.

Sergeant Moody, R.F.A., who has been awarded the D.C.M., was formerly on the staff of the Leeds Corporation's Bramley Tramway Depôt.

Corporal R. Barbair, formerly on the staff of the General Electric Co. at Glasgow, has been awarded the Military Medal.

Private J. H. Hopkins, who was formerly a motorman on the Beanwood route of the Birmingham Corporation tramways, has been awarded the Military Medal.

Lance-Corporal G. L. Mudie, R.E., who was an electrical engineer with Messrs. Mackenzie & Co., Dundee, has won the Military Medal.

Birthday Honours.—Mr. John Moxon, chairman of the Newport (Mon.) Electricity and Tramways Committee, is a recipient of the O.B.E. He is a practising solicitor.

In addition to those already mentioned here as appearing in the list of Birthday Honours, we should record that the honour of Knight Commander of the Order of the British Empire has been conferred upon Mr. W. Mackenzie, K.C., who acted as an arbitrator and conciliator in the industrial disputes under the Board of Trade and the Ministry of Labour. Sir William was chairman of one of the Commissions of Inquiry into causes of industrial unrest. At the inquiry into the Manchester engineering piece rates he acted as chairman.

Mr. C. A. Lister, J.P., the chairman of the M-L. Magneto Syndicate, Ltd., of Coventry, has been gazetted a Commander of the Order of the British Empire. Mr. Lister is a director of the firm of R. A. Lister & Co., Ltd., of Dursley, Glos.

Obituary.—Mr. Thomas Boddy, a director of the Northallerton Electric Light and Power Co. from its inception, died on Saturday last, aged 72 years.

Mr. E. C. Geale.—We regret to announce the death, on the 13th inst., at 10, Clifton Road, Crouch End, N., of Mr. Edward C. Geale, of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. He joined the head-office staff at the end of 188[illegible], and after serving in various capacities was appointed accountant of the company in 1903.

CITY NOTES.

South Wales Electrical Power Distribution Co. Mr. W. G. Dalziel, presiding at the annual meeting at Cardiff, said that the Treforest Co. made all payments and received all revenue for and on behalf of that company, and that was the reason why, so long as the present agreement remained in force, they had no revenue account to submit. The Treforest Co.'s share of revenue was limited to the 5 per cent. per annum interest, which they received on the prior lien debenture stock issued to them as security for the capital subscribed by their members from time to time for the purpose of assisting in carrying on the undertaking and providing for extensions of plant, mains, &c. Beyond this they did not participate in the revenue. The company's output showed a material increase; the units sold amounted to 36,959,049, as compared with 30,058,461 in 1916, an increase of 6,900,588, or nearly 23 per cent. The actual increase was very satisfactory from the point of view of expansion, but they had not been able to reap anything like the full benefit of this extension of business owing to the constantly increasing cost of material and stores, and the additional cost of labour under the various Government awards and decisions. In all the circumstances, they could congratulate themselves on the result of the year's working, for after payment of all working expenses, interest on prior lien debenture stock, and making due provision for depreciation of new plant, they earned the full interest, amounting to £10,000, on the original debenture stock of the company, and were able to carry forward a small balance. This was the first time in the history of the company that the whole of the interest on the original debenture stock had been earned in the 12 months during which it accrued. During the year under review, 1,660 additional h.p. had been connected to their mains, bringing the total up to 41,123 h.p., and negotiations had been completed for a further substantial increase of output. This new business included supplies to the Blaenavon Co., Ltd., for their works at Blaenavon, Messrs. Baldwins, Ltd., for their Panteg Steel Works, the Pontnewynydd Sheet & Galvanising Co., Ltd., the Crumlin Valley Collieries, the United National Collieries, Cross Keys and Nine Mile Point, and the South Wales Basic Slag Co. It was true that some of this business had come to them through the influence of the Ministry of Munitions, who had preferred that supplies should be taken from them rather than that certain works should put down their own generating plant, but in the majority of cases the business had reached them in the ordinary course. In either case it was gratifying to know that large electrical supply undertakings such as theirs were now being looked upon, not only by large users of power, but also by the Government, as an important, and, in fact, a necessary factor in the industrial life of the nation.

United River Plate Telephone Co., Ltd. Sir J. Gavey presided at the annual meeting on June 14th. He said that the growth of the system, which was temporarily checked on the outbreak of the war, had since then continued steadily to expand year by year until it had now almost reached its normal pre-war figure of annual increase. Although this result was in itself extremely gratifying, it had caused, and was causing, considerable anxiety to the management, both in London and Buenos Aires, owing to the extreme difficulty, and in some cases the impossibility, of obtaining supplies of plant in adequate quantities. It had only been possible to meet the increased demand for telephone service owing to the fact that considerable reserves, both in the shape of underground conductors and exchange switchboard equipment, had been provided prior to the year 1915. The only two sources of supply on which they could now draw were Great Britain and the United States, and as the needs of the war encroached more and more on the manufacturing industries of both countries, there was little prospect of much alleviation of their difficulties. If the war should be much prolonged it might be found impossible to meet all the demands for service by new subscribers for a time, but every effort was being made to avoid such a contingency. The gross earnings in Argentina and London amounted to £793,670, an increase of £84,444. Maintenance and other expenses of management had increased by £50,882, resulting in a net profit increase of £33,562. During the year, without any canvassing, 13,400 new telephone stations had been connected to the system; 8,180 had been withdrawn through subscribers discontinuing the service, leaving a net increase of 5,220 (as against 3,986 during 1916), bringing the total stations at the end of the year up to 65,788. The net increase for the year was only some 1,200 below the pre-war year of 1913. They might, therefore, hope that when times were again normal a very large telephone development would arise. The automatic systems in the cities of Rosario and Cordoba were working very satisfactorily, and continued to give good service, and in the former city they had under consideration the conversion to automatic working of a sub-exchange, known as Iriondo, so that before very long the whole of the city of Rosario would have automatic telephone service. During the year they entered into negotiations with certain independent telephone companies for the acquisition of their plant. Some of these, although they served important agricultural districts, were at present isolated, and therefore were limited in their use. Incorporation or alliance with the general service provided by the company would add immensely to the utility of the telephone to the inhabitants of such districts. After referring to commercial conditions in Argentina, Sir John said that during the year one of the directors, Mr. J. E. Kingsbury, paid a long-needed visit to the other side. He had several conferences with the local committee, visited the principal exchanges, and had presented an appreciative and valuable report. Mr. Kingsbury later addressed the meeting regarding his visit.

Lancashire Power Construction Co., Ltd. The report for the year ended March 31st, 1918, states that the trading profit of the Lancashire Electric Power Co. for 1917 amounted to £41,548, plus interest on hire purchase plants, &c., £483, making £42,031, compared with £39,839 for 1916. The balance brought forward was £7,703. Debenture interest absorbs £4,500. To reserve fund £15,000, dividend of 5 per cent. on shares £24,514, carried forward £5,721. The following figures indicate the development of the Parliamentary Co.'s business for three years:—

	1915.	1916.	1917.
Units generated	35,768,064	40,842,652	43,744,919
Maximum load in KW. ..	10 740	11,900	13,300
H.P. connected	29,000	30,600	34,000
Receipts	£72,395	£97,964	£115,131
Expenditure	£40,160	£59,254	£73,583
Profit on trading	£32,235	£38,710	£41,548

The Revenue of the Lancashire Power Construction Co., Ltd., shows that the total interest, dividend, and other receipts for the year ended March 31st, 1918, amounted to £29,024, and after deducting therefrom debenture interest, trustees' fees, and general charges payable, £18,455, there is left an available balance of £10.569. The directors recommend a dividend for the half-year ended March 31st, 1918, less income-tax, at the rate of 7 per cent. per annum on the preference shares, £7,507 being carried forward. The rearrangement of the capital has been accomplished. Sir R. A. Hampson and Mr. J. L. Rushton have resigned their seats on the board.

Barcelona Traction, Light & Power Co., Ltd.—Owing to the delay and complications resulting from the continuance of the war, affecting both the delivery and the cost of machinery and other supplies, it will not be possible for the company to resume full payment in cash of the interest on its bonds on December 1st next, as was contemplated when the bondholders met in June, 1915. The committee, in consultation with the directors, are therefore formulating a plan, the basis of which will be the payment in cash of a portion of the interest, commencing with the coupon due December 1st, with compensating arrangements for deferring payment of the full interest.—*Financier.*

Trowbridge Electric Supply Co., Ltd.—At the annual meeting it was stated that the concern was working at very high pressure, and considerable repairs would be necessary after the war. The managing director (Mr. J. H. Edwards) said that the plant was never designed for continuous running, but only for about five hours a day on the average, whereas they were now running 20 or 22 hours a day throughout the year. A reserve engine was being installed. The dividend of 7½ per cent. on the ordinary shares was approved.

Waygood-Otis Co., Ltd.—After paying preference dividend for 1916 and 1917, and putting £2,000 to reserve and £2,000 to reserve for depreciation of investments, £8,403 is carried forward.

Swansea Improvements & Tramways Co., Ltd.—A dividend of 6 per cent. on the ordinary shares is to be paid (after putting £3,000 to reserve), carrying forward £2,654.

Colombo Electric Tramways & Lighting Co., Ltd.—A dividend of 10 per cent., free of tax, is to be paid for 1917, £13,500 being put to reserve, and £8,655 carried forward.

Calcutta Electric Supply Corporation, Ltd.—Units sold to consumers during the four weeks ended March 1st, 1918, 2,080,083, compared with 1,776,965 units last year. Four weeks ended March 29th, 1918, 2,440,756, compared with 1,941,311 units last year.

Pernambuco Tramways & Power Co., Ltd.—A dividend at the rate of 3½ per cent. in respect of the year ending December next on the 7 per cent. non-cum. participating preference shares is announced.

Telephone Co. of Egypt, Ltd.—Six per cent., tax free, is being paid on the preferred and deferred shares, making 10 per cent. for the year. After putting £12,797 to income-tax account, and £8,446 to excess profits duty for 1916, £111,677 is to be carried forward.

Jas. Keith & Blackman Co., Ltd.—Dividend on the ordinary shares 10 per cent., and a bonus of 5 per cent., both tax free. To reserve £9,267; carried forward £16,253.

North Melbourne Electric Tramways & Lighting Co., Ltd.—During the year ended September, 1917, the gross receipts were £39,361, as against £40,358 in the previous year. Owing chiefly to advanced cost of wages and materials the expenses increased from £28,888 to £30,429. The net revenue was £8,932, against £11,470 in the previous year.

J. G. White & Co., Ltd.—Net profit £13,362. Following the precedent of the previous year, the directors decided not to pay an interim dividend in January, and are now recommending a dividend payable on July 1st on both classes of shares at the rate of 6 per cent. per annum. The directors recommend a dividend of 6 per cent., less income-tax, on the cum. pref. shares for the year to February 28th, £9,000; and a dividend of 6 per cent., less income-tax, on the ordinary shares for the year, £3,000; carried forward, £43,041.

STOCKS AND SHARES.

Tuesday Evening.

Business is certainly beginning to revive in the Stock Exchange markets. In spite of the steady depletion of members of the House and their clients, owing to the operation of the Man-Power Bill—a depletion, of course, which is going on all over the country—speculative investment is by no means dormant. In some of the markets connected with electricity there is a decided accession of activity, and another outstanding feature of the week is the improvement that has taken place in a good many of the railway stocks.

The most prominent issue amongst the lower-priced home rails is District Ordinary. Here, the price has risen another 1½ to 17, following upon the advance which has already taken place this month. There has been a little buying from the provinces, where interest has been quickened by the expectation that fares will be put up. Metropolitans gained ½ in sympathy. Underground Electric stocks are steady, but London Electric shares have gone back to 2¼. No doubt, the fact that nearly six months' dividends have accumulated in the prices of the dividend-paying varieties serves to stimulate the investment that is going on in this department.

Electrical manufacturing shares are buoyant. Edisons have risen to 3⅜ for the fully-paid, a jump of 15s., and the others are 3s. 6d. up at 41s. 6d. British Westinghouse Preference advanced to 2⅜. Rises have taken place in Cromptons, and a number of the lesser-known manufacturing shares. Siemens are one of the most active markets in the Stock Exchange at the moment, the statements made at the meeting last week having brought in a fresh rush of buyers. It is said that the block of shares which was bought from the Public Trustee, and which were held by him on alien enemy account, realised about £3 per share. They were put on the market at 4¼ to 4½, and the price has now risen to 5⅝. The shares are of the nominal value of £5 each, and are fully-paid. It may be that the rise has been sufficiently rapid.

Once more the air is thick with rumours of combinations and amalgamations. Some folks talk largely of the prospects that, at the end of the war, there will be but three manufacturing groups left, the rest having been absorbed or taken over in one way or another, and the trio is named as the British Westinghouse, General Electric, and Siemens. It is said that Vickers on the one hand, and the Metropolitan Carriage, Wagon & Finance Co., of Birmingham, on the other, are both concerned in the fusion of interests contemplated. Such reports are repeated only, of course, for what they may be worth, but they suffice to keep the market in a state of mild excitement, and are supplying the driving power which has forced up prices just lately.

Other manufacturing shares are also good. Rises in the cable group are maintained in some instances and improved upon in others, while the cable stocks and shares themselves once more show advances. In the case of some of these last-named, there is the additional attraction of the dividends being paid free of tax. In which connection, it may be mentioned that the General Electric dividend is now distributed in this way, and the yield in our column of prices is distinguished with the asterisk that marks dividends that are paid without deduction of the tax.

The electricity supply market is still overcast to some extent by the presence of deceased accounts which have not yet been entirely realised. However, substantial lines of shares have changed ownership within the last few days, and it should not be long before the market is freed from the incubus lately imposed upon it by the death of holders. The usual supporters of this section are rendered a little chary of touching the shares owing to the restriction placed upon consumption, upon which we have already commented, but this, as already pointed out, is not likely to make a great deal of difference to the companies supplying current for power. City Lights fell ¼ and County Ordinary ⅛, but the list as a whole shows a somewhat surprising degree of strength in view of the considerations that militate against the market for the time being.

Foreign investments are noteworthy from a recovery that has occurred in a good many of the Mexican stocks. President Wilson, in a recent interview to Mexican journalists, took a statesmanlike view of the situation so far as Mexico is concerned, and spoke of the future with hope and cheerfulness. This had a good effect on Mexican Government and railway bonds, though up to the present the market in Utilities has scarcely responded. The position is, however, that instead of shares being readily purchaseable, the previous sellers are now holding out for higher prices. Brazilian Tractions continue to be a weak market, and Anglo-Argentine Tramways remain under the depressing influence of the passing of the dividend on the first preference shares.

The iron and steel group is strong throughout. So many companies connected with the industry have lately declared a bonus in one manner or another, that buying is active, not only in London, but from South Wales, the Midlands, and further North. The rubber share market continues to be somewhat heavy, and amongst the base-metal mining shares, those connected with tin continue to attract a little attention. Victoria Falls Power shares are not much affected by the labour unrest that has arisen in the Transvaal, the prices of the Ordinary and Preference being 16s. 9d. and 23s. respectively.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price June 18, 1918.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	9	10	6½	—	£7 13 10
Charing Cross Ordinary	5	4	3¼	–	6 3 1
do. do. do. 4½ Pref...	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3		8 6 8
City of London	8	8	11¼	¼	7 2 3
do. do. 6 per cent. Pref. ..	6	6	9⅞		6 0 4
County of London	7	7	10⅜	⅛	6 15 0
do. do. 6 per cent. Pref.	6	6	10		6 0 0
Kensington Ordinary	6	7	5¼		6 13 4
London Electric	Nil	Nil	1⅛		Nil
do. do. 6 per cent. Pref...	4	5	3¼	-	7 13 10
Metropolitan	3	4	3⅛		6 8 0
do. 4½ per cent. Pref. ..	4½	4½	3⅜	-	6 13 4
St. James' and Pall Mall	8	9	6⅞	--	6 11 0
South London	5	5	2 3/16		7 2 4
South Metropolitan Pref. . ..	7	7	21/-		6 13 4
Westminster Ordinary	7	9	6¼		7 3 10

TELEGRAPHS AND TELEPHONES.

	Dividend 1916.	Dividend 1917.	Price June 18, 1918.	Rise or fall this week.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	94½	+ ½	6 7 0
do. Def.	1½	1½	22	—	6 14 10
Chile Telephone	8	—	8¼	--	4 17 0
Cuba Sub. Ord.	7	7	9¾	—	*7 3 7
Eastern Extension	8	8	15¾	—	5 1 7
Eastern Tel. Ord.	8	8	159½	+1	*5 0 4
Globe Tel. and T. Ord.	7	—	15	—	*4 13 4
do. do. Pref. .	6	6	10		6 0 0
Great Northern Tel. ..	24	22	38		5 15 9
Indo-European	13	--	49½		6 5 1
Marconi	15	—	3⅜	—	4 17 10
Oriental Telephone Ord. ..	10	--	4⅜	+ 1/16	2 5 9
United R. Plate Tel. .	8	8	7 7/16	+ ⅛	5 7 7
West India and Panama	6d.	9d.	1⅛	—	*3 6 8
Western Telegraph	8	8	15⅞	+ ⅛	*5 0 10

HOME RAILS.

	Dividend 1916.	Dividend 1917.	Price June 18, 1918.	Rise or fall this week.	Yield p.c.
Central London Ord. Assented ..	4	4	62½	—	6 8 0
Metropolitan	1	1	21¼	+ ½	4 14 1
do. District	Nil	Nil	17	+1½	Nil
Underground Electric Ordinary..	Nil	Nil	1¾	—	Nil
do. do. "A" ..	Nil	Nil	5/-	-	Nil
do. do. Income ..	6	4	76½		5 4 7

FOREIGN TRAMS, &c.

	Dividend 1916.	Dividend 1917.	Price June 18, 1918.	Rise or fall this week.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¼		6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3		-
do. do. 2nd Pref. .	5½		2½		
do. do. 5 Deb. ..	5	5	63	-	7 18 10
Brazil Tractions			41	1	
Bombay Electric Pref.	6	6	9½		6 6 4
British Columbia Elec. Rly. Pfce.	5	5	61½		8 2 8
do. do. Preferred	Nil	Nil	43½	—	Nil
do. do. Deferred	Nil	Nil	35	—	Nil
do. do. Deb. ..	4½	4½	63	—	6 15 0
Mexico Trams 5 per cent. Bonds..	Nil	Nil	37½	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	30	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	26½	—	Nil
do. 1st Bond ..	Nil	Nil	37		

MANUFACTURING COMPANIES.

	Dividend 1916.	Dividend 1917.	Price June 18, 1918.	Rise or fall this week.	Yield p.c.
Babcock & Wilcox	15	15	3⅜	—	4 9 0
British Aluminium Ord. ..	10	10	1 11/16		5 18 6
British Insulated Ord. .	20	20	3⅝		5 6 8
British Westinghouse Pref. ..	7½	7½	2⅜	+ ⅛	6 6 4
Callenders ..	20	—	17¼		5 16 0
do. 5 Pref.	5	5	4xd	+ ⅛	6 5 0
Castner-Kellner	22	20	3 5/16	—	6 0 10
Edison-Swan, fully paid ..	—	—	3⅜	+ ¼	Nil
do. do. 4 per cent. Deb. ..	4	4	75½	–	5 6 0
Electric Construction	7½	10	1¼xd	—	8 0 0
Gen. Elec. Pref.	6	6	10¼	—	5 15 8
do. Ord.	10	10	22	+ ½	*4 11 0
Henley	25	25	21	--	5 19 1
do. 4½ Pref..	4½	4½	3¾	.	5 12 2
India-Rubber	10	10	16¼	.	*6 3 1
Telegraph Con.	20	20	42½	–	*5 13 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 19th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/6	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£75	..
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£43	..
a	Copper Sulphate	"	£67 10/-	..
a	Potash, Chlorate	per lb.	2/6	..
a	" Perchlorate	"	2/-	..
a	Shellac	per cwt.	£16 15/-	..
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers ..	"	£35	..
a	" Lump	"	£25	..
a	Soda, Chlorate	per lb.	1/1	..
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c	" Tubes (solid drawn) ..	"	..	..
c	" Wire, basis	"	..	..
c	Copper Tubes (solid drawn) ..	"	1/7 to 1/7½	..
g	" Bars (best selected) ..	per ton	£147	..
g	" Sheet	"	£147	..
g	" Rod	"	£147	..
d	" (Electrolytic) Bars ..	"	£125	..
d	" " Sheets ..	"	£152	..
d	" " Wire Rods	"	£139	..
d	" " H.C. Wire	per lb.	1/4	..
f	Ebonite Rod	"	3/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/6	..
h	Gutta-percha, fine	"	6/10	..
h	India-rubber, Para fine	"	3/1	..
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£37	£5 dec.
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e	" " " medium	"	3/6 to 6/-	..
e	" " " large ..	"	7/6 to 14/- & up.	..
d	Silicium Bronze Wire	per lb.	1/8½	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	..	..
n	" Wire, Nos. 1 to 16	per lb.	4/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

British Electric Traction Co., Ltd.—Gross profit for the year ended March, 1918, £237,906, against £226,745. After deducting general expenses and the amount written off sundry assets £28,685, £209,221 remains, plus £97,598 brought forward. Debenture interest requires £90,978; there is put to reserve £21,172; 6 per cent. on the cum. pref. stock, £42,765; 3 per cent. on the ordinary stock, £39,788; carried forward, £112,116. The net profit shows an increase of £9,249.

The aggregate receipts of the associated companies show an advance, but the wages paid and the cost of materials have also increased, and larger provisions have been made for future repairs and maintenance. In the Metropolitan area war conditions generally have had a prejudicial effect. The question of increasing the statutory fares on tramways and light railways is now under the consideration of a Select Committee of the House of Commons. The reserve will now stand at £450,000. The investments stand at £4,262,958, and yielded a revenue of £210,361, representing an average of 4.93 per cent. for the year on the amount at which they appear in the balance sheet, as compared with 4.79 per cent. for the preceding year.

Oriental Telephone & Electric Co., Ltd.—Dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st last, less income-tax, and a final dividend of 6 per cent. on the ordinary shares, free of income-tax, making a total of 10 per cent. for the year, and a bonus on the ordinary shares of 1s. per share, free of income-tax.

Aluminium Corporation, Ltd.—The trading accounts for 1917 cannot yet be submitted, but the payment of a year's dividend on the 7 per cent. preference stock and shares is recommended

Fellows Magneto Co., Ltd.—At the first annual meeting, last week, Mr. V. L. FELLOWS said that the recommendations of the Lord Balfour Committee respecting protection for British magneto manufacturing must have an important bearing on the prospects of their company. Their business had rapidly developed, and they were now negotiating for a further increase of their factory. The type of magneto was of a much higher standard of quality than any pre-war Bosch design. For the new factory extensions they would require an additional £40,000. In replying to questions, Mr. Fellows said that the machines used at the present time were hardly dreamt of in 1916. The type of magneto of that date was soon obsolete. It was highly necessary for the company to make arrangements for dealing with the trade that would be done after the war.

NEW ELECTRIC PASSENGER LOCOMOTIVES.

The Westinghouse Electric & Manufacturing Co. and the Baldwin Locomotive Works have under construction for passenger service on the Chicago, Milwaukee and St. Paul Railway 10 direct-current, regenerating locomotives, which form part of the electrification extension.

The complete locomotive, with a total length over couplings of 90 ft., weighs ready for service 266 tons, and has an adhesion weight of 330,000 lb. The single cab is carried on the two main running gears, each having a four-wheel guiding truck, three driving axles in a 16 ft. 9 in. rigid wheel base, and a two-wheel trailing truck.

The main running gear centre pins are located midway between the first and second driving axles of each running gear. On one running gear the centre pin is designed to restrain the cab both longitudinally and laterally, while on the other the centre pin restrains the cab only laterally, permitting free longitudinal movement. This arrangement of riding and floating pins relieves the cab of pulling and buffing strains due to train load, as these strains are taken directly through the running gear side frames and bumpers. The driving wheels are 68 in. in diameter, and carry 55,000 lb. per axle. The guiding trucks have 36-in. wheels, while each two-wheel truck has a load of 38,500 lb. at the rail, with approximately 62,000 lb. distributed on each of the four-wheel trucks.

On any single driving wheel, the non-spring supported weight is that of wheels, axles, and driving boxes only.

The flexible type of quill drive is used to afford a means of permitting a motor located well above the road bed to drive an axle which, with its wheels, is free to follow the rail independently. This drive secures all the advantages of a flexible gear in cushioning the transmission of torque, and minimises the road shock.

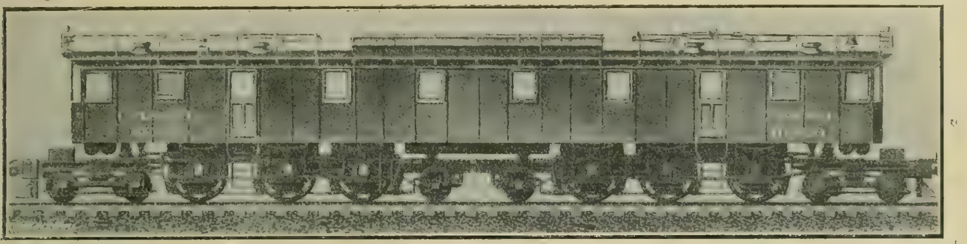


Fig. 1.—New Locomotive for Passenger Service on Chicago, Milwaukee & St. Paul Railway.

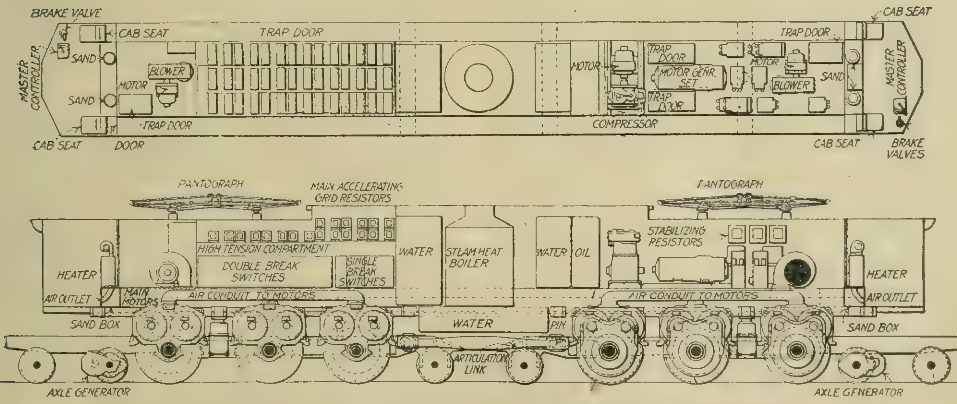


Fig. 2.—Elevation and Plan of Quill-drive Locomotive, showing Equipment.

Each main running gear has three-point equalisation, with a single point towards the end of the locomotive. The four-wheel guiding truck centre pin and cross-equalised leading pair of driving wheels are equalised together on the longitudinal centre line of the locomotive. The remaining two pairs of driving wheels and the two trailing wheels of the main running gear are side-equalised together again. The method of equalisation used here provides a weight variation on the driving wheels of only 6 per cent. from normal when the locomotive is pulling at 30 per cent. adhesion.

The centre of gravity of the main running gear, including motors, is 41½ in. above the rail, and the height of the centre of gravity of the complete locomotive is 63 in. above the rail.

One of these locomotive units is capable of hauling a 950-ton train (12 coaches) over the entire mountain section at the same speeds as called for by the present schedules. The one-hour rating is 4,000 H.P., and the continuous rating is 3,200 H.P., with a starting tractive effort of 112,000 lb. The normal speed on level track is 60 M.P.H., and on a 2 per cent. grade a speed of about 25 M.P.H. is maintained.

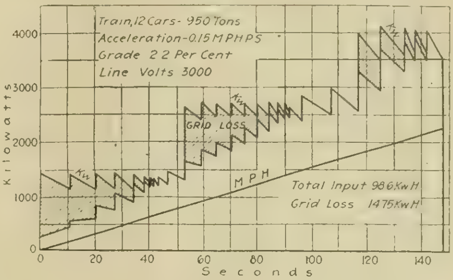


Fig. 3.—Typical Starting Current Graph, St. Paul Quill-drive Locomotive.

Flexibility of speed control is obtained by the use of nine running positions without rheostatic loss. The six 1,500-volt twin motors on one unit are connected for three-speed combinations as follows:—One set of six motors in series, two sets of three motors each in series, and three sets of two motors each in series.

Two additional running speeds are obtained on each speed combination by means of inductive shunts on the main motor fields, which assist in cutting down current peaks, as well as saving rheostatic losses. The speed range is from 8 to 56 M.P.H., depending on the road.

The use of the twin-motor design with quill drive permits effective use of the space between the driving wheels, and the use of two armatures, each wound for 750 volts direct current, geared to the same quill. This voltage is preferred to 1,500 on account of the better commutating characteristics inherent in motors built for the lower voltage.

The only high-voltage apparatus among the auxiliaries on the locomotive is the motor of the small motor-generator which is used for train lighting and charging the storage battery. Low-voltage auxiliaries were adopted to secure minimum complication of installation, maintenance, and operation. Ordinary inspection can be carried on, including the functioning of switches and auxiliaries, with no 3,000-volt power on the locomotive.

The regenerative control of these locomotives has been designed to secure positive operation of this feature over widely varying speeds. The same main motor combinations for "motoring" are used for "regenerating," except that the fields of the main motors are separately excited over a wide range by means of axle-driven generators. These are so connected with balancing resistance as to ensure inherent stability in the motor characteristics during regeneration.

These machines are mounted on the pony trucks of the locomotive and, in addition to exciting the motors during regeneration, furnish power for operating the air compressors and blower motors when the locomotive is hauling. This arrangement ensures a supply of current to the air compressor motors irrespective of the overhead trolley supply, and provides that compressed air will always be available for the use of the air brakes.

Each locomotive is equipped with an oil-fired steam boiler, designed to burn the ordinary fuel oil used by the railway company. Provision is made for a storage of 7,500 gal. of water and 750 gal. of oil in each engine.

(To be concluded.)

AN AUTOMATIC HYDROELECTRIC PLANT.*

By J. M. DRABELLE and L. B. BONNETT.

On October 2nd, 1917, there was placed in operation at Cedar Rapids, Iowa, the automatic hydroelectric plant of the Iowa Railway & Light Co. The station operates with no attendant, and the different generating units start or stop, depending on the flow of the river, or can be started and kept running by remote control from the main steam station. The an exterior view is shown in fig. 1. There are installed three 500-K.V.A. 80 per cent. power factor, 60-cycle, two-building is 112 ft. (34 m.) long, and 41 ft. (12.5 m.) wide; phase, 2,300-volt, 60-R.P.M. generators, of the vertical type. They are driven by waterwheels rated at 540 B.H.P., 60 R.P.M., under a 10 ft. (3 m.) head, the operating head varying from 8 ft. (2.4 m.) to 11 ft. (3.3 m.). The runners are of the Francis type, having a diameter of 171 in. (4.33 m.). The rotating element is supported by a thrust bearing at the top, supplied with oil by a pump driven from the generator shaft. The dame consists of nine spillway sections, each 60 ft. (18 m.) long, with automatic flashboards, the total overall length being 600 ft. (183 m.).

FIG. 1. EXTERIOR OF STATION—REAR VIEW.

There are two General Electric induction motor-driven exciter sets rated at 100 KW., 125 volts, each capable of carrying the entire excitation of the total development, namely, that of four generators. The motors are rated at 150 H.P., 2,300 volts, two-phase; 60 cycles, 1,200 R.P.M., and are designed to be started by the application of full voltage at standstill. The plant is designed to operate in parallel with the 19,000-KW. steam turbo-generating station of the Iowa Railway & Light Co., the steam plant being located at a distance of 3,300 ft. (1,006 m.) from the hydroelectric plant. The stations are tied together by one underground line consisting of two 600,000-C.M., two-conductor, concentric, 7,500-volt, varnished cambric, lead-covered cables.

The different generating units may be started and stopped either automatically, depending on the rise or fall of the water level in the river, or by remote control from the steam station when the plant is needed. To accomplish the latter, a bench board section, shown in fig. 3, was installed in the steam plant. On this, for each generator, there are provided three single-throw and one double-throw control buttons. The same benchboard contains for each generator an indicating ammeter and wattmeter, there being no instruments in the hydroelectric plant. The leads are wired through calibrating terminals at the hydroelectric plant, so that portable meters can be wired in if desired at any time.

The lower row of instruments on the benchboard is a totalising equipment, reading the total incoming power from the hydroelectric plant.

The waterwheel gates are not supplied with the usual hydraulic governor; but instead the opening and closing of the gates is obtained by a 5-H.P. induction motor through suitable reduction gearing. Each gate mechanism is equipped with a contact-making device operating indicating lamps on the benchboard at the Sixth Street station, showing the exact amount of gate opening. The correct sequence of operations in the control of each generator is obtained by properly placed segments on the drum of a controller, which is driven by a single-phase 1-H.P. repulsion-type motor. This controller definitely determines the proper time spacing between the different steps of starting the unit and connecting its generator to the bus.

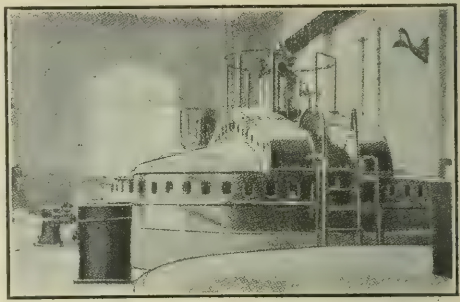


FIG. 2.—INTERIOR OF STATION.

For controlling the exciter sets, two oil-immersed contactors are used, also a double-throw, triple-pole switch, which connects either one or the other of the exciters to the exciter bus. A small induction motor which carries a centrifugal device on the end of the shaft is provided, which in case the frequency of the system rises to 64 cycles will open, and shut down the plant, thereby preventing runaway.

The units have individual float switches set for slightly different levels. If the water rises to a certain level it closes the float switch of the first unit, and that machine is started and put into service. If the flow of the river is such that the water continues to rise the second float switch closes, starting the second machine. The third switch is set still higher. The machines are shut down in the reverse order as the water level falls. In general the sequence of operation of each generator is as follows:—The closing of the float switch or the proper remote-control button in the steam station starts the exciter set (provided it has not already been started with another generator), and opens the waterwheel gate. When the generator comes up nearly to synchronous speed it is connected to the bus without field, but in series with a 20 per cent. reactance. A weak field is then applied, pulling the machine into synchronism. The field is then strengthened to full field, the reactance short-circuited, and the water wheel gates opened to carry full load on the unit. The generators operate with a fixed excitation adjusted for normal full-load value. If the water level is so low that with full gate opening normal load cannot be obtained, the generator, due to its high excitation, takes care of part of the wattless kilovolt-amperes of the system. The speed and voltage are determined by the steam turbine generators.

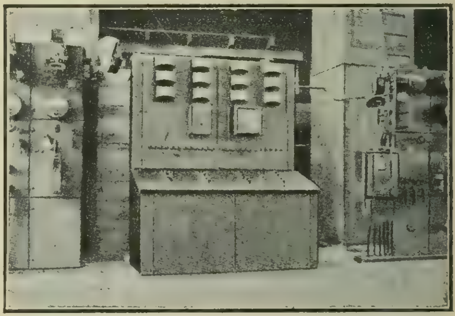


FIG. 3.—CONTROL BOARD AT STEAM STATION.

The detailed operation of this automatic equipment is fully described by the authors, who, by the aid of a wiring diagram, go over the various operations in rotation which are carried out when a generator is run up and put on load.

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* *Proceedings*, A.I.E.E., Vol. 37, No. 5.

Each controller has a relay, so that the exciter can be started from any controller; that is, any generator can be started first, and its controller starts the exciter. The steam station is equipped with control buttons so that, if desired, the gate opening, and therefore the load on the hydroelectric generators, can be controlled from that place. The ammeter control is cut out by opening button No. 1.

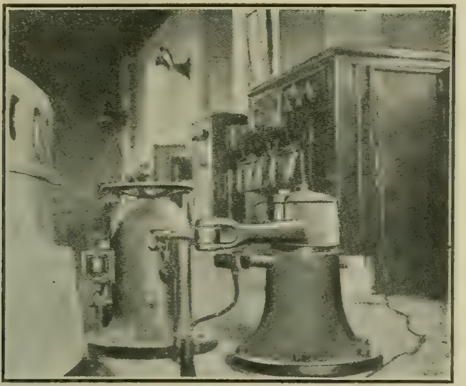


Fig. 4.—Gate Control.

A considerable number of tests were taken to determine what would happen in the automatic equipment in case of incorrect operation of the control buttons, or failure of some parts to operate correctly.

First, one of the No. 1 control buttons was opened and the load on the generator controlled by hand. It was found impossible to overload the generator, even with the gate opening to the full amount allowed by its limit switch. Button No. 1 was then closed, putting the ammeter again in control, and at the same time the operator tried to control the load from the gate control buttons. It was found that he could increase or decrease the load as desired; but when the hand-control button was released the ammeter returned the load to the proper amount determined by its setting. Buttons Nos. 2 and 3 were opened and immediately reclosed. The opening of these buttons tripped out all contactors and started the gate motor closing. The reclosing of the buttons caused the controller to go through the usual sequence of starting. This proved that if the operator accidentally opened one of these buttons and immediately closed it again, the generator would not be thrown immediately back on the bus, but would go through its proper sequence of operations.

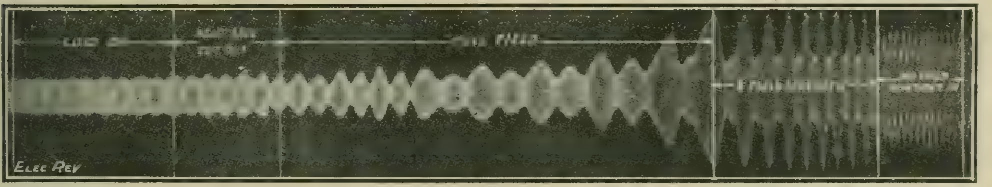


Fig. 5.—Oscillogram of Generator Current during Starting Period.

In the steam station there is a voltmeter connected on the hydroelectric side of the oil switch. This oil switch was next tripped, and it was found that the voltage dropped to zero in about two seconds, indicating that in this time the contactors in the hydroelectric plant had all tripped out, thus clearing the generators from the bus. Upon tripping of this oil switch the generators lost their load and tended to run away. Within the two seconds mentioned the speed-limit device trips a relay, and all contactors drop out. The automatic throw-over control switch connected the separate source of power to the control bus, the dropping out of the contactors closed the water wheel gates, and the speed of the machines rose to not more than 20 to 25 per cent. above normal. The action of the gate is quite rapid, and the inertia of the machines is such that the gates closed before the wheels had time to accelerate seriously. With the generator running under load the exciter set was shut down. The armature current of the generator immediately increased and the contact-making ammeter started to close the gate. The contactors connecting the generator to the bus dropped out, due to the tripping of the direct-current, low-voltage relay, which dropped because of the failure of the exciter voltage. The generator, after loss of field, broke from synchronism and tended to run above speed, but the contact-making ammeter had already closed the gate far enough to prevent serious overspeed, and the drop out of the contactors completed the closing.

Since the hydroelectric plant has been put into regular operation, the exciter in the main steam generating station failed one day. The load on the system was much greater than the hydroelectric plant could carry by itself, so that this plant should shut itself down and clear from the steam plant. As soon as the exciter voltage in the steam station began to drop, the current of the hydroelectric generators rapidly rose, and the contact-making ammeters started the closing of the waterwheel gates. Before the voltage dropped too low the ammeters had almost completed the closing of the gates. All contactors dropped out because of low voltage, disconnecting the generators from the bus. The hydroelectric plant was ready to start again upon return of voltage on the tie cable between the two plants.

Although the generators are slow speed and have considerable inertia, only 39 seconds are required from beginning the opening of the gate until the generator is connected to the bus, with the reactance short-circuited. Within 45 seconds the generator is carrying full load. In spite of the speed with which these generators are connected to the bus, there is no serious mechanical jar perceptible.

Since the plant has been in operation no troubles, other than the small ones which always go with any new development, have been experienced, and these have all been of a very minor nature. The plant has successfully withstood short circuits, exciter failures in the steam plant, low and high water, and all of the tests that those in charge of the work could conceive of, wrong operations being brought about artificially. It has also been operated by the regular operating force at the steam plant, and there has been no occasion to keep men in the hydroelectric plant to watch its operation.

The station has been in operation about seven months. During that time, the total flow of the river has been used at all times, and a toll of approximately 3,000,000 kw.-hr. has been fed into the system.

The automatic development means that it will now be possible to develop a large number of small low-head plants and tie them in on a high-tension system, leaving their operation entirely to the float switch and voltage relays. If there is voltage on all three phases of the high-tension line and water for the turbines, they will start up and go on the line without wrecking themselves or disturbing the operation of the rest of the system.

With the elimination of the excessive labour cost of operation of a small plant, many water-power sites are capable of development as a paying investment.

Taking Proper Care of Reactors.—As alternating-current stations grow bigger, the importance of reactors to serve as protection against short-circuits becomes greater. The average engineer has a very meagre idea of the tremendous forces exerted by reactors when big currents arising from a short-circuit occur. The installation of reactors transfers the major part of the troubles from the generator to the reactor, hence in the design and installation of these much care has proved to be necessary.

M. E. Skinner's paper on this subject in the *Electrical World*, of May 4th, throws a vivid light on the electrodynamic problems of reactor installation. The reactors in practical use are always without iron cores. They are akin to the primary circuit of a coreless transformer adapted to carry very great currents, and usually take the form of coils of bare wire with the turns supported on fireproof and non-magnetic material. They are too big to immerse conveniently in oil tanks, so reliance is placed on air as a dielectric. The temperatures reached under short-circuit conditions may be very high. Ordinary insulating materials would be of little service even if one attempted to employ them.

Particular pains must be taken to keep the reactor coil away from closed metallic circuits of every kind, to prevent loss of energy, and even possible overheating, so that in installing reactors it is necessary to pay close attention to the surroundings.

Manchester Tramways. — It is expected that the further revision of the fares and stages on the Corporation tramways will be submitted early next month. The basis of the new scale will be 1d. for the first two miles from the centre of the city.

A NEW ELECTRIC PARCEL VAN.

There has recently been introduced in the London parcel service of the London & North-Western Railway a new electrically propelled van, of which, by the courtesy of Mr. W. A. Ree, outdoor goods manager at Euston, we are enabled to reproduce an illustration. The van, which presents a businesslike and neat appearance, is being tested on various routes in London, and is, we understand, doing good work in the collection and delivery of parcels handled by the roalway company.

Messrs. Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich, are the makers of the chassis, which is adapted for 50 cwt., and known as their "Orwell" electric chassis. The electric equipment consists of two compound motors, each individually capable of transmitting from $2\frac{3}{4}$ to 7 B.H.P., according to actual load and speed. It is equipped with series-parallel control, the detailed mechanism of which has been worked out with great thought and care. The chassis is fitted with the standard charging plug approved by the Electric Vehicle Committee, and is so interlocked with the control that the latter must be in the off position during the charging of the battery. The frame consists of pressed steel girders supported on springs over each axle; all bolts and springs are enclosed in brass bushes and fitted with lubricators. Two independent mechanical brakes of the internal expanding type are provided, both of which act on the back wheels.

The Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester, supplied the battery equipment, which consists of 40 cells of I.M.V.7 "Ironclad-Exide" type with a capacity of 226 ampere-hours at the five-hour rate. Several distinctive features are included in the design of the battery, and its ability to stand heavy boosting charges has been proved in use, while it can be discharged at any rates that the other current-carrying parts of the vehicle will accommodate. There is no difficulty in obtaining its listed capacity, as it is conservatively rated.

The body of the vehicle was constructed at the Wolverton Carriage Works of the railway company. The workmanship and finish of the whole van is excellent.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1

9,104. "Electric motors." H. A. Whiteside. June 3rd.

9,115. "Conversion of electric currents." C. N. Bennett & Lyon and Wrench. June 3rd.

9,149. "Battery charging apparatus." Igranic Co. (Cutler-Hammer Manufacturing Co., U.S.A.) June 3rd.

9,226. "Electrodes for electric smelting &c." S. C. Hazard & H. S. Morris. June 4th.

9,241. "Self-excited alternators." E. C. Diem. June 4th. (France, November 22nd, 1915.)

9,249. "Electric furnaces." D. Pitt. June 5th.

9,282. "Ignition systems for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. June 5th.

9,322. "Electrical connectors." C. G. Bennett & H. Garde. June 6th.

9,323. "Electrical insulating bushings." British Westinghouse Electric and Manufacturing Co. June 6th. (U.S.A., June 8th, 1917.)

9,324. "Sparking plugs for internal-combustion engines." H. V. J. Jouffret. June 6th. (France, December 29th, 1917.)

9,328. "Lock for carbon electrodes." W. Marr. June 6th.

9,330. "Electric relays." Fuller Accumulator Co. & A. P. Welch. June 6th.

9,331. "Electric booster relays." Fuller Accumulator Co. & A. P. Welch. June 6th.

9,345. "Dynamo-electric machines." British Thomson-Houston Co. and J. Martin. June 6th.

9,346. "Vacuum electric discharge devices." British Thomson-Houston Co., H. W. Edmundson & W. T. Munn. June 6th.

9,360. "Automatic telephone exchange." P. McEvoy. June 7th.

9,363. "Electric horns for motor cars, &c." H. Hamnett. June 7th.

9,398. "Sparking plug for ignition." A. E. Heath. June 7th.

9,399. "Appliance for connection of electric conducting wires to sparking plugs, magnetos, batteries, &c." A. E. Heath. June 7th.

9,400. "Electric connections." C. Hellyar & T. H. Hellyar. June 7th.

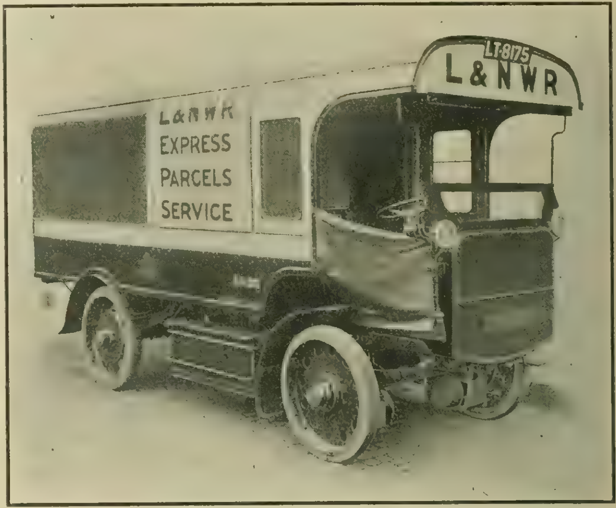
9,419. "Electric switches." C. L. Breeden & H. Lucas. June 7th.

9,430. "Electric installation systems." Atelier H. Cuenod Soc. Anon. June 7th. (Switzerland, June 21st, 1917.)

9,454. "Electric safety lamps." Fuller Accumulator Co. & A. P. Welch. June 8th.

9,461. "Sparking plug attachment for internal-combustion engines." P. G. Harriott. June 8th.

9,469. "Electrically-heated crucibles, melting pots, &c." Morgan Crucible Co. & C. W. Speirs. June 8th.



New 50-cwt. Electric Parcel Van.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

3,585. Galvanic Cells. R. Schuster. March 12th, 1917. (115,653.)

4,882. Method of or, and Means for Individual Electric Driving of Machine Tools, such as Lathes, Drilling, or Milling Machines. H. Scholey. April 4th, 1917. (115,655.)

6,867. Electrically-operated Diaphragm Horns. E. C. R. Marks (Sparks-Withington Co.). May 14th, 1917. (115,679.)

6,870. Couplings or Connections for Electric Cables, particularly intended for use on Railway Vehicles. J. Stone & Co. (M. Walton). May 14th, 1917. (115,680.)

6,871. Brush and Terminal Contact Mechanism of Dynamo-electric Machines. J. Stone & Co. and A. H. Darker. May 14th, 1917. (115,681.)

6,889. Method of Installing and Disposition of Electrical Equipment for Motor Road Vehicles. T. L. R. d'Orville. May 14th, 1917. (115,682.)

6,936. Loading Coils for Telephone Circuits. British Insulated & Helsby Cables, Ltd., G. E. Bairsto & H. H. Harrison. May 15th, 1917. (115,685.)

7,206. Ionic Electric Relays, Amplifiers, or Detectors. S. G. Brown. May 18th, 1917. (115,700.)

7,519. Means for Preventing the Oxidation or Wasting of the Electrodes in Electric Furnaces. W. B. Hamilton & J. Holland. May 25th, 1917. (115,705.)

7,618. Means for Controlling Internal-combustion Engines. P. Hooker, Ltd., & H. Pollard. May 26th, 1917. (115,707.)

7,627. Telegraph Relays. E. C. R. Marks (United Telegraph & Cable Co., U.S.A.). May 26th, 1917. (115,708.)

8,478. Electric Furnaces. O. Sahlin. June 13th, 1917. (115,719.)

8,621. Electrical Switches. W. Ellerd-Styles. June 15th, 1917. (115,721.)

8,622. Dynamo-electric Apparatus for Motor Vehicles. H. Lucas, C. L. Breeden & H. E. Moore. June 15th, 1917. (115,722.)

9,216. Vaporising and Igniting Means for Internal-combustion Engines. A. Bellville. June 27th, 1917. (Addition to 5,464/17.) (115,727.)

11,990. Means for the Desired Distribution of Load and Current on Direct-current Units Connected in Parallel. Akt. Ges. Brown, Boveri et Cie. August 21st, 1916. (109,799.)

12,460. Selector Systems for Telegraph Typewriters. A. E. Alexander (Kleinschmidt Electric Co., U.S.A.). August 30th, 1917. (115,757.)

13,332. Electrical Limit Switches. Allmanna Svenska Elektriska Aktiebolaget & E. H. Lindblom. September 17th, 1917. (115,761.)

18,935. Magnetic Blow-out Fuses. Switchgear & Cowans and G. H. Neep. December 21st, 1917. (115,779.)

1918.

1,048. Control of Dynamo-electric Machinery. J. C. Wilson. January 18th, 1918. (115,786.)

1,172. Transmitting Keys for use in Electric Telegraphy. Marconi's Wireless Telegraph Co. & V. A. Smart. January 21st, 1918. (115,787.)

4,952. Electric Relays. D. A. Christian. March 20th, 1918. (115,796.)

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ELECTRICAL REVIEW.

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NOTICE TO READERS.

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TRADE ASSOCIATIONS.

ONE of the most definite and least controversial parts of the report of the Committee on Commercial Policy after the War is that which deals with the formation of trade associations, and the need for such associations is almost universally realised. They can, of course, do some very useful work in many ways. It must not, however, be overlooked that, like every other good thing in this world, they are liable to abuse, and one of the great objections to combinations and associations of all kinds has always been that they would seek to tyrannise over the rest of the community by establishing monopolies or otherwise exercising restraint of trade. A case in point now appears to have arisen.

The Association of British Chemical Manufacturers was formed about a year ago, but not very much had been heard of it until just recently, when it opposed the grant by Parliament of certain powers to electric supply companies which would enable these companies in effect to work up and sell their by-products. The *Chemical Trade Journal* for May 4th says:—

> The Association of British Chemical Manufacturers has scored a distinct success in its brief fight against the proposals in a number of electric power Bills which have been deposited in Parliament this session. The Shropshire, Worcestershire, and Staffordshire Electric Power Co., the County of London Electric Supply Co., and the Gloucestershire Electric Power Co. had clauses in their Bills—which related to the use of certain lands for the erection of electricity generating stations—asking for powers, in addition to the generation of electricity, to manufacture gas and to "produce, work up, convert, sell, and dispose of any material products, matters, and things arising or used in the process of the generation or transformation of energy or power, and any electrochemical, electrometallurgical, and atmospheric products, and any residual products arising directly or indirectly from the manufacture of gas by the company," to quote from the clause in the Shropshire Bill. Petitions were deposited against all three Bills, but early in the session the Gloucestershire Electric Power Bill was withdrawn. The Association's case against the grant of general and wide powers of this description was that they are quite unprecedented and entirely outside the scope of an electric supply company, and if sanctioned and exercised would enable electric supply companies to compete with members of the Association, under favoured conditions, in the manufacture and sale of chemicals. The powers in question would enable electric supply companies to convert the residual products resulting from the manufacture of gas, either alone or in combination with other chemicals and products, into various chemicals, and also to manufacture other chemicals and sell them in the open market in competition with ordinary chemical manufacturers, who have sunk large capital sums in the erection of plant and in the establishment of their businesses. Furthermore, it is urged that no public advantage can be shown which would justify the grant of the powers in question.

It will be seen that the grounds on which the Association bases its opposition are (1) the proposed powers are unprecedented; (2) they are entirely beyond the scope of electric supply companies; and (3) no public advantage will accrue. To talk about precedent in these days is ludicrous in the highest degree, since all precedents have now been thrown to the winds. Even in normal times a slavish adherence to precedent was an infallible sign of weakness and timidity, but in these unprecedented days it is a good deal worse. Then, in the second place, it is urged that the powers in question are beyond the scope of supply companies. Is it seriously urged that a body of men representing, or pretending to represent, one industry, should presume to dictate to another industry what are its proper bounds and limits? The electric supply companies are to be prevented from ngaging in an entirely legitimate and subsidiary enterprise closely bound up with their main operations, first, because it is unprecedented, and secondly, because it is beyond their scope! It would be interesting to know if the chemical manufacturers would wish to be debarred from certain enterprises involving the working up of by-products merely because it might be unprecedented; and also whether they would wish the power companies to define for them the exact scope of their operations, beyond which they must not go because it might be unprecedented.

But the most amazing part of this extraordinary exhibition of short-sighted selfishness and petty tyranny, attempting to establish a partial monopoly, is the third argument adduced—namely, that no public benefit can be shown. Why, then, does the Association object?—for if no public benefit can be shown, this can only mean that the products in question cannot be supplied by the power companies at a cheaper rate. But almost in the same breath the Association is bemoaning unfair competition. If the power companies can supply these products more cheaply than some of the chemical manufacturers, so much the better for the public; and in this case it is absurd to pretend that no public benefit can be shown. In any case, folly could hardly go further than to pretend that the power companies should not be given an opportunity of extending their operations, and showing a very welcome spirit of enterprise, and selling these products more cheaply—merely because it might be unprecedented and beyond their scope. The first two alleged arguments then are no arguments, and the third, if there is anything in it, works against the Association to its confusion rather than its justification. Moreover, these products are in many cases the raw materials of other chemical industries, and to this extent the Association would apparently penalise one branch of chemical industry in favour of other branches.

It seems clear, therefore, that some of these Associations, at all events, may abuse their powers and seek to further their own interests to the detriment of other industries or the nation as a whole, and some sort of control is certainly needed. If Parliament cannot exercise this control, then it should be the business of some great national body to see fair play and put a stop to unwarrantable interference and attempts to impose restraints of trade and limitations on legitimate enterprise. It is the Associations and not the electric power—or other—industries that require to have their scope and activities strictly limited and clearly defined.

The I.M.E.A. Meeting.

The meeting of the Incorporated Municipal Electrical Association, which was held at Manchester, last week, was one of the most important in the history of that body; for upon the attitude of the Association towards the Report on Electric Power Supply depended in a large degree the fate of the measure which it foreshadowed. The interests of the members are intimately bound up with the industry dealt with in the Report, and as Mr. Pearce pointed out in his extremely able commentary, there was not one of them who would not be more or less directly affected by its proposals; how, then, would they regard it—from the point of view of the national welfare, or from that of conservatism and supposed self-interest? But we hardly need put the question; the Association is all-British, "militantly British," and the verdict was never in doubt for a moment. Criticism there was in abundance; but it was mostly friendly criticism, and the sense of the meeting was unmistakably in favour of the Report from the first. It was bitterly hostile, however, to the Report on Coal Conservation, which was only mentioned to condemn it as anti-municipal, fallacious, and otherwise highly objectionable.

The fundamental principles embodied in the Report on Electric Power Supply—namely, State ownership and management by District Boards under the supervision of permanent Commissioners—were accepted practically unanimously, though the financial proposals came in for a good deal of criticism, and the constitution of the District Boards was considered capable of improvement. The immense responsibility imposed upon the Commissioners prompted the suggestion that a larger number than three, or even five, should be appointed, and it was pointed out that all of them ought to devote their whole time to their duties, lest any should have private axes to grind. The "flexibility" of the Report was generally commented upon, but this is really a valuable quality, as it enables the Commissioners to cope with almost any imaginable set of circumstances on common-sense lines without exceeding their powers. Naturally, the question of compensation for displaced officials came under consideration, and the engineers of some of the smaller undertakings showed some anxiety as to their future prospects; but, as we have already urged, and, as was pointed out by some of the speakers, they need have no fear on this score. They surely do not wish to spend their lives in small stations, and in view of the coming developments, there will be plenty of openings for them "higher up." We quite agree, however, with the contention that the compensation clause should not be merely permissive, as it stands at present, but obligatory.

The question whether "super-stations" of more than, say, 100,000 KW. were inherently more economical than smaller stations was raised, and not unreasonably: in this connection the statement of a Canadian correspondent in our last issue is worthy of attention. It was also pointed out that in many industries which require steam for heating and other purposes, electrical energy could be obtained almost as a by-product, and certainly at very low cost. The problem of utilising the immense quantities of heat which are at present deliberately thrown away in the cooling water was referred to; in our opinion, this matter calls for the closest investigation. The true importance of cheap electricity to industry was challenged, in view of the very small proportion of the cost of power to selling price of manufactured goods in many branches of industry, and it was urged that in point of fact the saving of coal was even more important to the nation than the reduction in cost of energy; another important matter was that an abundant supply of power should be obtainable, and that it should be extended to the country as well as the town.

For the many other interesting points that were raised, we must refer our readers to our report of the three-hours' discussion. Turning to the business meeting, we would call attention to the decision to form local centres, and the instruction to the Council to approach the Committee on Production with regard to the applicability of the war bonus to chief engineers. Lastly, as evidence of the importance attached by the meeting to the Report on Electric Power Supply, we may add that the Association has decided to meet again directly the draft Bill of the Board of Trade is published.

Substitutes for Overhead Copper Conductors in Germany.

The seizure of large quantities of copper in Germany for war purposes has rendered the maintenance of the overhead-conductor systems a matter of difficulty. A writer in the *Elektrische Kraftbetrieb und Bahnen* for March 24th, 1918, discusses the best method of maintaining the overhead wires in running condition under such circumstances. In a double-wire system an iron wire can be substituted for one of the copper conductors, the conductivity of the iron wire being improved by connecting it at frequent points to the copper wire. Steps should be taken to keep existing copper wires in running condition as long as possible. Protecting sheaths should be provided at points and cross-overs and at section insulators, at which places wires are subject to breakage by the trolley. Where the wire is particularly exposed to wear, sections of iron wire should be interposed, and the copper wire should be retained only for carrying the current, the iron wire taking the mechanical wear. When copper conductors are not strong enough to be used for trolley contact they should be replaced by iron wires, the worn copper conductor being suspended alongside of the iron wire for the conduction of the current. The trolley wheels must be kept in very efficient running order, so as to prevent sliding friction on the overhead line as far as possible.

A STEEL WORKS ELECTRIFICATION.

Running at the Frodingham Iron and Steel Works, Scunthorpe, Lincolnshire, was a 14-in. three-high non-reversing merchant mill driven through gearing by a single-cylinder engine, the cylinder dimensions of which were 36¾ in. diameter by 36 in. stroke, running at 100 R.P.M., and operating at a nominal steam pressure of 90 lb. to the sq. in., but often falling to a much lower figure. The engine was equipped with a 12-ft. 6-in. fly-wheel, having a rim weighing 21,000 lb., and power was transmitted to the mill through gearing with two speed changes. When rolling heavy sections the speed was reduced in the ratio of 29 to 16, but for lighter work, where a higher speed could be used, it was reduced in the ratio of 23 to 22 by changing the gears.

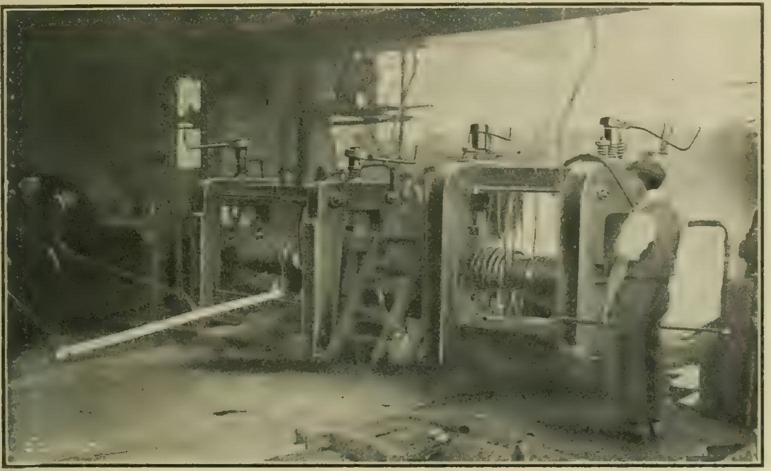

Fig. 1.—Rolling Mill at Work.

The management decided to electrify the mill, with a view to obtaining an increased output. It was decided to supply the mill with sufficient power to roll the heavier sections, and to obtain a wider range of speed variation by means of shunt regulation on the motor without the intervention of the gearing. Moreover, it was wished to include a flywheel sufficiently heavy to reduce the peak loads to below 900 H.P., commensurate with the limited amount of power available. This power was to be obtained from gas engines incapable of overload, and with only 900 H.P. to spare.

To avoid the complications of gearing it was decided that the mill should be driven direct by the motor, the full-load speed of which would in consequence range from 72 R.P.M. for the heavy to 150 R.P.M. for the light sections. To settle the size of the flywheel, a number of tests were made upon the steam mill. Due to the inability of the engine to develop adequate power for the output required, indicator diagrams alone did not afford the requisite information, and the following tests were therefore taken:—The instantaneous drop in speed of the engine and flywheel was measured many times for the heaviest passes in the roughing rolls, and the time of the pass was also taken. From the known weight of the flywheel, the time of pass, and the drop in speed, it was possible to calculate fairly closely the power required by each roughing pass. Continuous indicator diagrams were taken for all the passes, but particularly for the long finishing pass, occupying 10 or more seconds. During this pass the energy given by the flywheel was only a small portion of the total, and the engine had to exert a torque sufficient to roll out the section without assistance from the flywheel. The horse-power required to do this was obtained from the continuous indicator diagrams taken in conjunction with the speed and time figures.

The tests on the finishing and roughing rolls were taken separately, so that the heaviest loads of each pass could be taken independently, and combined together to give the conditions under which the motor would have to work when rolling sections in both sets of rolls at the same time. Very frequently the engine pulled up under such conditions, so that a reliable estimate of the power needed could only be calculated by combining the results of individual tests. Having obtained the figures for the existing flywheel and engine, it was possible to calculate the amount of compounding, and the size of the flywheel that would be required on the motor. The weight of the flywheel had to be such that it would give out the additional energy required if the heaviest roughing pass occurred during the period of the heaviest finishing pass, with a suitable drop in speed, so that the load on the motor did not exceed the stipulated 900 H.P. In making the calculations, allowance had also to be made for the extra power given out by the motor as it slowed up. Very careful calculations were made, and it was eventually decided to install a flywheel having a stored energy equivalent to 35 tons revolving at a radius of gyration of 5 ft. The calculated figures agreed very closely with the results obtained: the maximum horse-power required was actually about 10 per cent. below the calculated figures.

It was decided to install a continuous-current, compound-wound, interpolar "Witton" motor, capable of developing 750 B.H.P. as a normal continuous load with a temperature rise not exceeding 72° F. after six hours' run at 72 R.P.M. The motor was so compounded that it had a drop of 20 per cent. between no-load and full-load. A diverter was provided so that the amount of compounding (and consequently the drop in speed) could be instantly adjusted on the switchboard to suit the best conditions of rolling. Further, the motor was so designed that the speed could be increased by shunt regulation up to 180 R.P.M. at light load.

The motor was coupled to a flywheel having a total weight of about 45 tons, and approximately 12 ft. 8 in. in diameter. To give ample strength, this flywheel, which was of the disk type, had an additional cast-steel rim about 12 in. deep shrunk over the outer periphery, bringing up the weight to the figure mentioned above. The stored energy of the combined armature and flywheel amounted to about 3,650,000 lb. at 100 R.P.M. The motor and flywheel were combined into a three-bearing set, the centre bearing being extra large, so as to take the combined weight of the armature and the flywheel. The bearings, which were lined with special white metal, had oil-ring lubrication, and, in addition, overload flood lubrication from a small pump, belt-driven from the motor shaft. The flywheel shaft ran in the two outer bearings at one end, and was connected to the motor by means

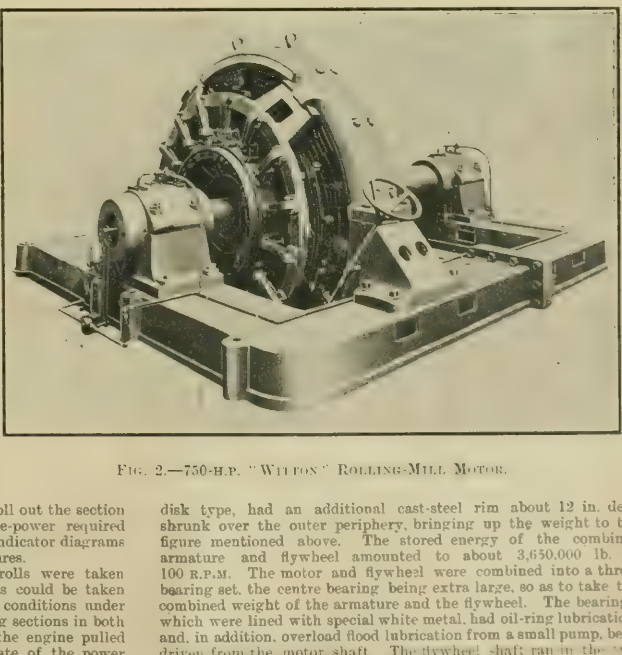

Fig. 2.—750-H.P. "Witton" Rolling-Mill Motor.

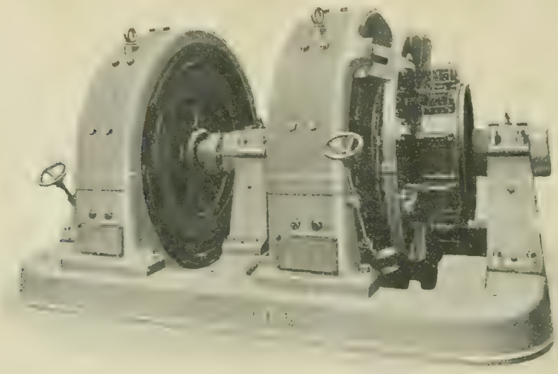

Fig. 3.—750-kw. Motor-Generator.

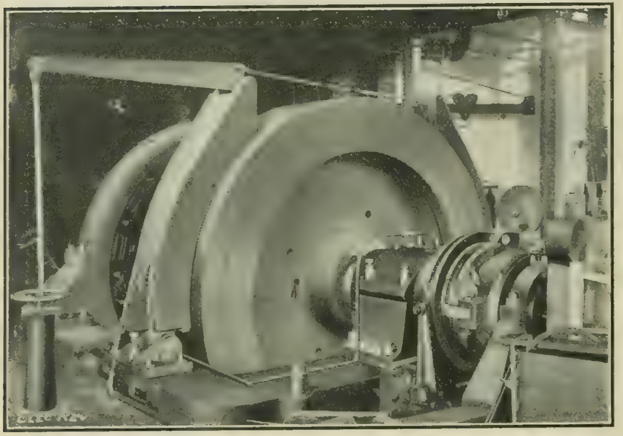

Fig. 4. A 45-ton Rolling-Mill Flywheel.

of a solid coupling, forged with the shaft, and bolted to a coupling forming a portion of the armature spider. By this means it is possible to remove the armature without disturbing the fly-wheel or its bearings.

It was decided to make the change from steam to electric drive in as short a time as possible; the engine was dismantled, and the mill restarted, driven by the electric motor, with a total stoppage of only 11 days. To reduce the time required for the stoppage to a minimum, it was proposed to utilise as far as possible the existing engine foundations, and the bed of the motor was so designed that a number of the existing engine foundation bolts were used for bolting down the motor. The shape of the existing foundation was such that very little alteration was required to make it suitable for taking a three-bearing motor and flywheel. The set was provided with a mechanical disconnecting trip coupling, so that the mill could be instantly stopped while the motor and flywheel continued running. In addition, a water-cooled post-brake with powerful hand-wheel was fitted on the combination bedplate, the brake being arranged to press on the turned surface of the flywheel. The ratio of leverage was so adjusted that sufficient pressure could not be applied to cause dangerous stresses, but the set could be pulled up in between one and two minutes.

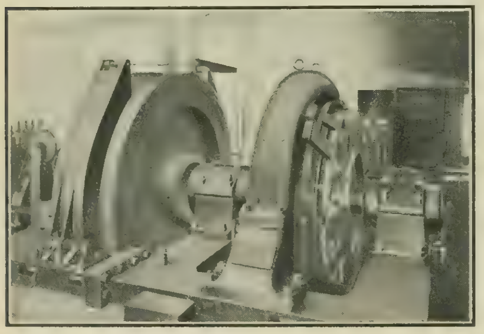

Fig. 5.—Rolling-Mill Motor and Flywheel at Work.

The switchgear for controlling the motor consists of enamelled slate panels fitted with ammeter, voltmeter, shunt regulator for varying the speed within the two-to-one limits of the motor, a double-pole main switch, overload and no-voltage circuit-breaker. A switch was also provided for reversing the direction of rotation at a slow speed for emergency use. On the board is mounted a multiple knife-switch diverter for the series windings. Each switch diverts a certain amount of current from the series turns, and thus alters the compounding. When all the switches are closed, the machine practically acts as a shunt-wound machine, with only about 5 per cent. drop in speed between no-load and full-load. The starter for the motor was also mounted on the board, and consisted of a multiple-switch starter with interlock, so that the switches must be closed in the right order.

An interlock was provided between the starter and the shunt regulator, so that the motor could only be started with full field at the slowest speed. After the motor had attained the minimum full speed, the speed could be increased up to the maximum by the shunt regulator as required, but only when the starting resistance had been cut out of circuit. The starting resistance itself consists of heavy cast-iron grids, liberally rated, and capable of starting the motor against 750 h.p. for a period of two minutes. Additional interlocks were provided between the breaker and the starter, so that the breaker could not be closed unless the starter was in the "off" position.

The installation at the Frodingham Iron and Steel Works also includes a large 750-kw. "Witton" motor-generator used for the purpose of coupling together two portions of the works operating at different voltages. The machine converts from 460 to 230 volts, the low-voltage side having a continuous capacity of 7,500 amperes.

The whole of the installation was supplied by the General Electric Co., Ltd., of Witton, Birmingham, and London.

Thanks are due to the Frodingham Iron and Steel Works for permission to take the photographs and to publish this description.

GLOVER'S DETECTIVE AND PROTECTIVE DEVICES FOR CABLES.

In 1912 Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester, designed and patented a cable which entailed the addition to a cable of ordinary construction of a subsidiary or test conductor in the form of a spirally-wound copper tape, surrounding the insulated conductors and insulated from the lead sheath (or from the armour in the case of non-lead covered cables) by a thin layer of hygroscopic insulating material. Any external injury to the cable must entail damage to the insulation of the test conductor before the main insulation is affected. The hygroscopic dielectric between the test conductor and the earthed sheath is made of a minimum thickness to withstand the maximum mechanical damage which may be encountered in laying the cable, and at the same time to have an insulation resistance of the order of 50 to 100 megohms per mile. It will, therefore, be clear that a test of the insulation resistance of this thin dielectric will always give a reliable indication as to the integrity of the lead covering or other waterproof sheath.

The facilities afforded by the test sheath for obtaining definite information as to the internal condition of cables have been utilised, first, for the customary periodical insulation tests on networks and on feeders in vulnerable positions; secondly, for the purpose of keeping a constant watch on the condition of the cable by testing at any desired moment (with the cable "alive") by means of the detective arrangement shown in fig. 1.

These arrangements allow the whole of the dielectric to be explored without the necessity of isolating the cable.

The test conductor is normally connected to earth, switch position (*a*), and by moving the switch to positions (*b*) and (*c*) respectively, any leakage from the cores is indicated and measured. If no appreciable leakage exists, movement of the switch to position (*d*) enables an insulation resistance test of the test sheath dielectric to be made, and any exterior damage rendered apparent and localised. An incipient fault on a power supply system has actually been located by a fall of potential test along the test sheath whilst the feeder was kept alive and supplied power at 6,600 volts. Slight damage may thus be detected in the initial stages without interruption to the supply, and incipient faults may be located and repaired before serious and widespread troubles have been caused by effects secondary to such damage.

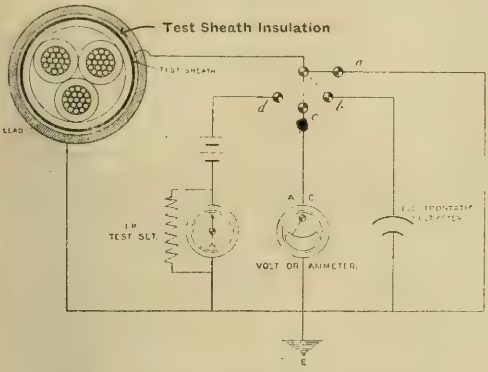

Fig. 1.—Glover's Detective Arrangement.

The development of a special protective system for use with the test sheath type of cable has provided a third and much wider sphere of usefulness. This, in combination with the detective arrangements above referred to, has been patented, and is known as Glover's Patent Detective and Protective System.

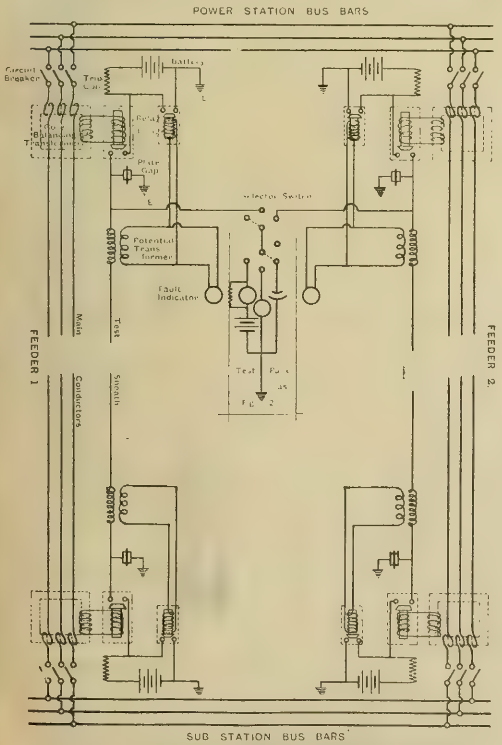

Fig. 2.—Diagram of Glover's Protective Gear.

Fig. 2 illustrates the essential features of this system, and a cursory examination of the diagram will make it apparent that the protective gear is virtually a combination of leakage and core balance protection, and will show how the detective arrangements, together with alarm devices, such as signal lamps or bells, are combined therewith.

It will be seen that the test sheath is connected at each end to the high-tension side of a potential transformer having comparatively low ohmic resistance, but high reactance. The other high-tension terminal of this transformer is connected, first, to one terminal of a contact-maker actuated by an A.C. relay (1) which is connected in series with the secondary of a core-balancing transformer; secondly, to a plate gap, arranged to break down to earth at a predetermined voltage, energising the potential transformer and the relay (2) in its secondary circuit; thirdly (at power-house end only), to a selector switch making connection with an insulation testing panel as shown in fig. 1.

The feeder circuit-breakers are actuated by trip coils of the moving-coil type, energised by a battery or other D.C. source of supply, one pole of which (the *same* pole at each end of the feeder) is connected to earth. Each trip-coil circuit may be completed by either of the two contact-maker relays (1) and (2) mentioned above.

First, assume the case of external damage to the cable penetrating to one of the cores. A heavy current passes from that core to earth, upsetting the core balance, actuating the relays (1). Simultaneously the test sheath is metallically connected to earth, so that the circuit-breaker trip-coil circuits are completed through the test sheath, earth and batteries, causing the circuit-breakers to open, and isolating the faulty feeder. At the same time, the core-balance on any sound feeders (supplying in parallel) will have been upset, actuating the relays (1), but, there being no earth on the test sheaths of these feeders, the trip-coil circuits are *not* completed, and are therefore not energised.

Secondly, assume that there is a leakage from any one core to the test sheath (*e.g.*, at a joint), but that no connection is made to earth. The potential on the test sheath will rise until it reaches a predetermined point at which the plate gaps will puncture, making connection to earth and energising the potential transformers and relays (2). The circuit-breaker trip-coil circuits are thus completed, and the faulty feeder is isolated.

Fig. 3.—Patent Sheathed Joint.

Joints are admittedly the weakest point in a cable network, so that it is important that these should be "sheathed" as efficiently as the cable itself. Fig. 3 shows Glover's patent "sheathed" joint. The cores may be jointed and insulated in any approved manner. The copper test sheath tape is cut on each side of the joint in such manner as to leave about 1 in. of overall paper exposed between it and the point of splaying out the individual conductors; about 1 in. of copper sheath is left bare, and about another inch of paper is left between this exposed copper sheath and the lead of the cable. The gap in the test sheath is bridged by about a dozen or so small copper wires, insulated with a double braiding of cotton and woven into the form of a cage. This cage work is impregnated with insulating compound immediately before use, and it is slipped over the cable before the conductors are jointed. When this operation is completed, the cage is bound down and sweated at one end. It is then arranged with correct clearance around the conductors, and it will be found that the cage readily assumes a symmetrical position. The wires are then bound down at the other end, and any small surplus on the wires is neatly trimmed off. The lead sleeve is then placed in position over the completed joint, and is plumbed and filled in the usual manner. Thus the electrical continuity of the test sheath is efficiently maintained across joints, the main current-carrying conductors are entirely sheathed by the test conductors at joints, and there is no obstruction to prevent the compound flowing freely around and into all the interstices of the joints.

Summarised, the advantages claimed for the system are:—Damage is detected *immediately* by insulation resistance tests between the test sheath and lead, and complete breakdown may thus be forestalled. By means of the test sheath, insulation tests may be taken whilst cables are "alive" and in commission. This has the further advantage that the condition of the insulation is observed at *working* pressures and under normal *working* conditions. High resistance faults between core and lead covering may be located by fall of potential tests taken between test sheath and lead. In the event of complete breakdown, the faulty cable is instantaneously disconnected. The device discriminates between sound and faulty cables feeding in parallel, also slight and serious primary damage, indicating in the former and disconnecting in the latter case. Joints are "sheathed" as efficiently as the cable itself.

THE ASSOCIATION OF BRITISH ELECTRICAL ENGINEERS.

A meeting convened by the Birmingham Local Section of the Institution of Electrical Engineers was held at the University, Birmingham, on the 17th inst., to consider the proposed formation of an Association of British Electrical Engineers (Electricity Supply). Mr. S. T. Allen (chairman of the Birmingham Local Section) occupied the chair.

Mr. R. A. Chattock explained to the meeting the objects of the Association, and defined the suggested qualifications for membership. He said the necessity for the formation of an association of this kind had recently been occupying the attention of electrical engineers, and several associations had sprung up for attaining the objects that he had mentioned. It was obviously not desirable to have a number of associations of this kind all working with the same end in view, and the matter was brought to the notice of the Council of the I.E.E., and was very thoroughly considered by it. It was felt that it was highly desirable to co-ordinate the efforts of all these associations, also that if one was selected it would probably have the effect of preventing the others from joining it; it was therefore decided to try and form an entirely new association, which should be backed by the weight and influence of the I.E.E., and which should amalgamate all the existing associations. A body so formed would be exceptionally strong, and it would be able to carry sufficient weight. The objects of the Association could only be attained by negotiations with employers' associations, and the fact that a body like the I.E.E. was in sympathy with the objects of this association, and was actively supporting it, must be of immense value in carrying on such negotiations. The suggestion that members of the association should be corporate members of the I.E.E. was put forward with the idea of ensuring that the status of the members was suitable for occupying positions of responsibility; failing this, some form of examination would probably have to be prescribed which members would be required to pass in order to demonstrate their fitness for responsible posts. There was no doubt that employers would want some sort of guarantee as regarded fitness, and membership of the premier electrical Institution should be amply sufficient, requiring as it did the passing of a technical examination. It was deemed desirable that members of the proposed association should not put themselves in the same category as the working operatives' trade union, where a standard rate of pay was demanded, but no standard of efficiency was offered, or even aimed at. The criticism had been offered that the junior engineers could not afford a subscription to this association and to the I.E.E. as well. This was a very important point, and he wanted to impress upon the audience that if they were going to use the great influence of the I.E.E. in bettering their positions and salaries, it was only fair that they should accord what support they could to that body. There must be hundreds of electrical engineers who were not members of the I.E.E., and if they all joined up, as he felt very strongly they should, they would not only be supporting the I.E.E., but they would be rendering its influence on their own behalf still greater by increasing its numbers. The I.E.E. had been criticised in the past for doing so little for its members. This criticism might have been deserved, but if it had, he could not help feeling that it was entirely the fault of the members themselves for being so apathetic. Now it appeared that some of the members had awakened, and were trying to do something tangible for their fellow members, with the result that they were again being adversely criticised by the very men they were trying to help. The idea underlying the formation of this association was to make it embrace other sections of electrical engineers as well. Each section would have its own council and executive, with representation upon a grand council, which would be closely allied with the Council of the I.E.E. In conclusion, Mr. Chattock moved the following resolution:—"That this meeting of electricity supply engineers, called by the Birmingham Local Section of the Institution of Electrical Engineers, approves the formation of the proposed Association of Electrical Engineers," adding that similar resolutions had been passed in Newcastle, Glasgow and South Wales.

After a full discussion, the resolution was carried. A resolution was passed recommending that the new association should be associated with the I.E.E.; also that the proposed association should be constituted in the already existing E.P.E.A. Four delegates were appointed to attend the mass meeting to be held in London, viz.:—Messrs. P. T. Burgess, F. Forrest, C. Jones, and J. T. H. Legge.

THE ELECTRICAL TRADES AFTER THE WAR.

Report of the Departmental Committee.

(*Continued from page* 582.)

Section I.—Electricity Generation and Transmission.

As the production of generating and distributing plant forms the chief part of electrical manufacturing it has been necessary to consider whether present methods of generation and distribution are adequate, and if not how they can be improved. The witnesses examined on these points concur in the opinion—

(*a*) That it is of vital importance to every industry to have a free circulation of cheap and efficient power supply.

(*b*) That owing to obstacles caused by the present administrative methods, which they unanimously condemn, the supply has till now been deficient, with consequent serious loss to the nation.

(*c*) That the removal of these obstacles will be followed by a widespread extension in the use of electricity and a greatly increased demand for every kind of electrical plant.

The home demand alone for electrical machinery and apparatus should already have been sufficient to employ a manufacturing industry with at least three times the present output. There is, therefore, urgent need to place electrical energy at the disposal of all manufacturers and at the lowest possible price, which can best be done by the employment of large units in large central generating stations with suitable interconnection between the various areas of supply. This will involve the subordination or discontinuance of the smaller and uneconomical power stations.

The obstacles complained of arise partly from the prevailing official atmosphere, and partly from legislative enactments. In this country the attitude towards electrical progress has been far too restrictive, in contrast with the widespread official and public encouragement of the use of electrical energy abroad. The existing procedure is complicated and responsibility divided.

In the past, lack of foresight in the granting of authority for the supply of electricity has allowed even adjacent undertakings to establish works differing, not only in type of plant and mains, but also in pressures and frequencies, with the result that linking-up and interchange of power is now extraordinarily difficult and costly.

In cases where provision for compulsory purchase has been inserted, in the supposed interest of the public, it is impossible for the undertakings, as the time of purchase approaches, to keep abreast of technical progress or to expend fresh capital to the best advantage. Attention is also called to the anomalous inequalities of tenure as between municipalities, Parliamentary companies, and companies working under Provisional Orders.

The general consensus of evidence is that all matters concerning the development of electrical supply should be placed in the hands of a new and independent Board of Commissioners free from political control and untrammelled by past traditions.

The evidence leads the Committee to the following conclusions:—

1. That Government should recognise the dependence of the State, both from military and industrial standpoints, upon the supply of electrical energy regarded as a "*key industry*."
2. That the distribution of electrical energy should be regarded no longer as a parochial, but as a national question of urgent importance.
3. That the present system of electrical generation and distribution is behind the times, and is a serious handicap in international competition.
4. That the present conditions are mainly due to faulty legislation and to divided, and therefore, weak executive control.
5. That remedial and unifying legislation governing the supply and distribution of electrical energy should be introduced forthwith.
6. That it is imperative that questions concerning the distribution of electrical energy should be freed from political influence, and considered solely from the point of view of national requirements, technical possibilities, and naval and military needs.
7. That co-ordinated and well considered schemes are necessary to enable local developments held over during the war to be handled on proper lines when peace is declared.
8. That the determination of questions concerning concentration of generating plant, with a resulting economy of coal and other savings, requires immediate attention.
9. That only by such steps can the electrical manufactur

ing industry of this country be fully developed, not only for the home trade, but as a consequence for the great industry now maturing overseas; that the gain to the State from a well-planned scheme of reconstruction will be inestimable; and that the items which are capable of reasonable calculation, such as saving in fuel, reduction in factory costs, and increased output, will together represent not less than £100,000,000 per annum.

Section II.—Electric Traction.

In deliberating on electricity supply on which electrical manufacturing so largely depends, the Committee has had to consider the position of electric tramways and light railways, and, to some extent, the general electrification of railways in the United Kingdom. The output of electrical energy for traction purposes is already nearly 1,000,000,000 units per annum.

Much evidence was given to show that the Tramways Act, 1870, having been framed in the days of animal traction, is long since out of date, that the procedure under the Light Railway Acts, instead of being cheap and expeditious as intended, has proved to be the reverse, and that improved legislation is required. The paralysing effect of the purchase clause in the Tramways Act was illustrated by many cases given in evidence, and frequent reference was made to the report of the Royal Commission on London Traffic (1905), and the recommendations therein on the subject of the local veto.

An acknowledged traction authority urged, in advocating the establishment of an independent Board of Electricity Commissioners, that one of its most important duties should be the framing of a simplified model Bill to replace the Tramways Acts, 1870, and the Light Railways Acts. This model Bill would deal with some of the anomalies and disabilities under which the tramway industry at present suffers—as, for instance, recurring periods of purchase, the incidence of the burden of road repairs, periodical revision of fares, and the settlement of rating questions and running powers.

The Committee concurs with the evidence that unless there be a complete revision of the present powers, the development and growth of tramways and light railways will continue to be impeded, with a consequent reduction in the demand for manufactured products.

The electrification of railways demands consideration from a national point of view. It should be dealt with homogeneously, and not be allowed to develop in a piecemeal and desultory way. A witness of great experience stated that a return of from 10 to 15 per cent. on the capital involved could be secured from the electrical operation of some of our important railway systems. The witness added that the conveniences of electric traction were probably more important than the direct financial results. He was quite satisfied from a thorough investigation of two complete systems (one a very important main line) that electric traction *per se* would pay.

The Committee is of opinion that such an important development as the electrification of railways, which will certainly take place in the near future, should be carried out in accordance with some settled general principle, so that all main or local lines may be properly co-ordinated, and the power stations placed in positions which will have regard to both military and civil needs.

Section III.—Manufacturing.

This section starts by defining "electrical manufactures" as including boilers, turbines or engines, and the electrical generators which they drive, and the mains, instruments, and apparatus connected with the distribution and consumption of electrical energy. It is stated that the manufacture of electrical machinery and apparatus has been, with few exceptions, far from prosperous. "Most of the companies have sustained serious losses, necessitating the writing down of capital. . . . Thirty-two electrical firms with an aggregate initial paid-up capital of just over £15,000,000 have been obliged to write off no less than £3,125,000. . . . Few of such companies have ever earned a satisfactory return on their capital. The notable exception has been cable-making, which has been consistently successful in maintaining its lead, both in the quality of its manufactures and in financial results, and has thus been able to hold its own in the world's markets." "Even allowing for mistakes inevitable at the inception of an industry, and for the rapid advance of electrical science, involving changes in types of machinery, the Committee is convinced that the results would not have been so generally unfavourable but for the hampering conditions peculiar to this country." "On the other hand, the German electrical manufacturing industry has been very prosperous." The report gives in the following table the approximate annual value before the war of the total products of electrical plant, mains, and appliances in Great Britain and Germany respectively :—

	Great Britain.	Germany.
Total electrical products ...	£22,500,000	£60,000,000
Exports	7,500,000	15,000,000
Imports	2,933,000	631,000
Consumption of *home-made* machinery	15,000,000	45,000,000

The approximate annual value of home-made electrical machinery used in Germany before the war per 100 people was about £70, which contrasted with a consumption in this country of only £33.

Of the £22,500,000 manufactured in this country, a large proportion has been produced by concerns under foreign control, and in the case of British exports a proportion is known to consist of foreign manufactures reshipped as British goods. In addition to the legislative obstacles to the full development of the trade, there was another important factor, namely, that in the initial stages foreign countries possessed a pioneering advantage in the fact that their general industrial progress had not then reached so high a degree of development as had Great Britain in the application of steam engineering. Great Britain, on the other hand, had undoubtedly attained great prosperity and technical efficiency in her use of steam plant, and there was therefore less inducement for her manufacturers to adopt electrical driving. On the Continent, however, the introduction of the use of electricity coincided with the advance in manufacturing industries, and there was every inducement to employ the new agent, especially as it did not involve the scrapping of power plant still in good condition. Many of the greatest electrical inventions originated in Great Britain, and there is little doubt that, as in the case of steam, our lead would have been maintained had the prevailing conditions been equally favourable, particularly as this country already possessed ample skilled labour on account of its existing engineering development. Another factor retarding electrical progress in Great Britain has been the strength of the gas interests and the influence they exerted to stifle competition. Again, foreign Governments, appreciating the importance of conserving their home markets as a basis for the development of overseas trade, imposed protective duties, and exerted influence on State Departments to purchase native goods. The German Government has always been ready to help its manufacturers to extend their trade abroad. German diplomacy has been freely placed at the service of German industry, and, when necessary, has not hesitated to exert pressure in the highest quarters. The policy of German manufacturers has been studiously directed not only to secure orders in this country under the open competition permitted by our fiscal system, but also to the effective destruction of British industry. Their business methods have been expressly designed to dominate the markets of the world, to which end they could count on unlimited support from their Government and their banks. An industry cultivated under such encouraging conditions has had an immense advantage in international competition in open markets. Such markets included the United Kingdom, the Dominions of the British Empire, and the South American Republics, whose industries had been largely developed by British capital, especially in the field of railway construction, and German manufacturers have made strenuous efforts to secure and hold those markets.

The importance of a close connection between finance and manufacture cannot be over-estimated. German financiers have always identified themselves with German industries, and it has been their custom, when providing money for a concession or contract, to enforce the use of German-made machinery. This applied not only to the original contract, but to subsequent replacements and extensions, the importance of which in a new and constantly developing field has not hitherto been sufficiently appreciated by British manufacturers and financiers.

Some British companies operating in South America have, owing to the influence of German finance, entirely ceased to purchase British goods. Many instances have been cited, including the well-known case of the Victoria Falls Co., in which orders which ought to have come to Great Britain, were by financial influence secured to Germany. At the outbreak of war, negotiations were in progress for the acquisition by Germany of financial control in existing companies in the United Kingdom, as well as in the British Dominions and India, which, if successfully concluded, would have still further restricted the use of British goods in many parts of the Empire.

Much of the floating finance to enable German manufacturers to secure and carry out their contracts both abroad and in British Dominions, has been provided in London, so that our financiers and discount houses have often found the means by which Germany has fought the British manufacturer.

The Committee has been struck by the thorough organisation of, and close co-operation between, the leading German manufacturers, and by the strength of the links which connect them with the affiliated organisations abroad. There is conclusive evidence of the existence of German control over companies ostensibly British, and that German control has also often been exercised, to the detriment of British interests, indirectly through companies incorporated in America, Switzerland, and other neutral countries. For several years past there has been in Germany a consistent policy of amalgamation and association, and several establishments of world-wide importance have thus been built up. Only two or three German companies are seriously engaged in the electrical business overseas, and the competition which British manufacturers have to face is almost entirely with these houses. But these competitors, though few, have immense resources, with highly trained staffs and competent workmen, their factories are well equipped, they have established branches all over the world, and maintain elaborate research laboratories. They have enormous financial strength, for, in addition to their own capital, they are closely bound up with leading financial institutions not only in Germany but elsewhere on the Continent, in a manner which does not exist in Great Britain.

In contrast with this policy of association, which has proved so successful both in Germany and in America, Great Britain has always discouraged combination, fearing a rise of prices to the detriment of the consumer. As a result of this policy of isolated effort, numbers of small concerns have arisen, each struggling against the other for bare existence. By association it would be possible to manufacture each class of apparatus in the most suitable factory, the management of which would thus be concentrated on its own specialty instead of being wasted on a variety of products. It is essential that output should be thus consolidated instead of remaining in the hands of a number of weak concerns, many of which, moreover, have further reduced their competitive power by dabbling in a variety of productions. The Committee is convinced that under properly organised combination or association the cost of production will be materially reduced, and that there is no reason to fear that enhanced prices will be charged to the consumer as a result of such combination. If electrical factories, which are unquestionably necessary on national considerations, are to be maintained in a state of efficiency, steps must be taken at the earliest possible moment to deal with the problem. A sound and permanent industry can be established not only to supply the home market, but to secure a much greater proportion of the overseas trade of the world. This can be done either by amalgamation among the companies engaged in the industry or by the development of the practice of association for common purposes. In whichever direction action be taken, the Committee is convinced of the need for reform. Only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations, which not only manufacture, but undertake comprehensive contracts, make powerful financial alliances, and thus exert in every direction greater influence than is possible in the case of any individual firm.

An important advantage resulting from such combination would be the extension of standardisation, which the Committee considers is of the highest importance from a national as well as from an international point of view. It is to be hoped that the Government will do its utmost in future to accept recognised standard plant, as its example in the past, in calling for modifications, has had a pernicious influence on other buyers. During the war makers' standards have perforce been accepted, and have been found to satisfy all practical requirements. While it is hoped that in the case of heavy plant, British standards may be acceptable abroad, makers must be prepared to adjust themselves to the needs of the country concerned, where accessories of a different type have become universal. It cannot be expected that our export trade will compete successfully in the future unless the language, prices, and measures current in each country are employed in the catalogues and descriptive matter issued.

The necessity for protective duties has been emphasised by many witnesses connected with manufacturing interests, and has been frankly recognised by representatives of purchasers. The Committee is convinced that adequate protection is necessary, and should be given at least for a period.

(*To be continued.*)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Water-Testing Apparatus.

The presence of salt in boilers is highly objectionable. In the ordinary course, the water in boilers is tested regularly by the salinometer; these tests are satisfactory so far as they go, but give no indication of the rate at which salt is entering the boiler.

The Simplex Patent Salt Detector, made by Bromell Patents Co., Ltd., 12, Bath Street, Liverpool, is designed to give a continuous indication of any salt in the feed water, and thus show the presence of salt there before it enters the boiler; also in the event of a sudden increase of salt it gives warning immediately. The apparatus is very simple, its working being based on the fact that pure water has a high electrical resistance, which falls if certain compounds are added to the water. The essential part of the apparatus is a glass vessel fitted with two electrodes, by which a current is passed through a sample of the feed water. The necessary current is taken from any convenient power or lighting circuit, either direct or alternating current. The electrodes are made of a special grade of carbon, and are so arranged that no metal part of the connections is in contact with the water. The electrodes are adjustable, so that the sensitiveness of the instrument can be varied.

In the Simplex apparatus a resistance is introduced which is preferably in the form of an incandescent lamp. By varying this resistance (by using lamps of different candle power), the sensitiveness can be varied as desired. A high-candle-power lamp gives greater sensitiveness, and a low candle-power less sensitiveness. The voltage of the lamp should be slightly lower than the line voltage. The lamp shows no light when the water is fresh, but as soon as salt is present, will begin to glow a dull red, which gradually increases to full brightness as the salt increases. The brightness of the lamp enables it to be seen at a glance whether there is salt in the feed, and whether it is in sufficient quantity to require immediate attention. The voltmeter gives a quantitative indication of the amount of salt present, and may be calibrated, if desired. This cannot be done with any great accuracy, in the majority of cases, as the readings vary considerably with the temperature of the feed water. If desirable a definite warning may be given by a bell or buzzer, which is arranged to operate by a relay connected in series with the instrument.

As will be seen from the illustration, the whole apparatus is self-contained in a polished teak case, with a plate-glass door. The buzzer is fitted to the outside of the case, while the connection to the electric circuit is made by a plug, so that a connection can be taken from any lampholder. The various indicators—voltmeter, lamp, and buzzer—can equally well be fitted in any other position, and at any distance from the instrument.

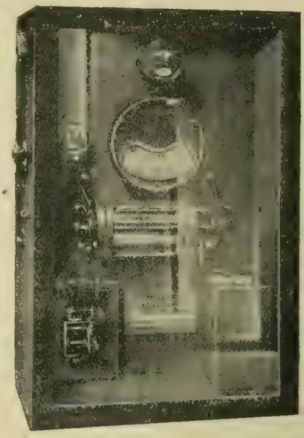

Fig. 1.—The Simplex Patent Salt Detector.

Should a log be required showing the condition of the feed throughout a watch, a recording voltmeter with a roll or circular chart operated by clockwork in the usual way may be fitted. The sensitiveness of the instrument is very great, and compares well with that of the nitrate of silver test. One grain of salt per gallon can readily be shown. It is thus very suitable for use in connection with the distilling of fresh water for drinking purposes. While the apparatus was intended, in the first instance, for use in marine work, there are many other applications in connection with chemical works, &c., which will readily occur to those familiar with them.

The Wild-Barfield Electric Muffle.

The Wild-Barfield muffle comprises an inner cylinder of highly-refractory material and an outer cylinder from which it is insulated by special lagging. The inner pot is wound with a heating and magnetising coil, the ends of which are connected to terminals on the exterior of the outer cylinder. The latter is wound with a coil of special wire, which forms the pyroscopic detector and automatically gives the change point of carbon steel, similarly connected with terminals to the galvanometer circuit through a special device known as a compensator, which has been designed for balancing inequalities of voltage in the heating and magnetising circuit in order to give a clear and steady reading on the galvanometer scale. It consists of a hard-wood frame wound with

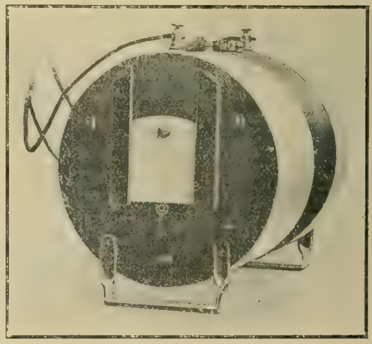

Fig. 2.—The Wild-Barfield Electric Muffle.

primary and secondary coils of insulated copper wire connected to terminals for the electric supply and galvanometer circuit respectively.

A regulating switch is supplied to keep the current within the necessary limits of heating required. The current consumption is comparatively small; a muffle having an internal chamber dimension of 12 in. × 4 in. takes 1,400 watts to reach a temperature of about 1,000° C. On account of the excellent heat-resisting qualities of the lagging used, the heat losses are small.

It will be readily seen that the advantages of this furnace are numerous. In addition to laboratory work, it is used for hardening drills, annealing, &c., and, as the furnace is portable, it can be used in situations where the use of other types would be impossible. It should be noted that the adoption of the pyroscopic detector, in conjunction with any type of furnace, ensures the finest possible grain, and prevents the steel becoming overheated.

The apparatus is made by AUTOMATIC & ELECTRIC FURNACES LTD., 6, Old Queen Street, S.W. 1.

LEGAL.

HUME *v.* FERRANTI, LTD.

IN the King's Bench Division, on June 18th, a Divisional Court, composed of Mr. Justice Shearman and Mr. Justice Sankey, heard an appeal from the judgment of Judge Hogg, in the Oldham County Court, in this case.

MR. RIGBY SWIFT, K.C., appearing for the defendants, who were the appellants, said that the judgment from which he was appealing was given on December 20th, 1917, and was in effect that the plaintiff was entitled to £2 14s. for breach of an implied undertaking by the defendants to find plaintiff a reasonable amount of work. The amount in dispute (said counsel) was a small one, but the case governed a great many others, and it was regarded as a test case. It was really a point of substance as to procedure raised under the Munitions of War Act, 1915, and the Acts amending it. The learned County Court Judge thought so, and gave costs on the High Courts scale. Plaintiff was an iron moulder in their engineering works at Hollinwood, near Manchester. He was a piece-worker, and his average earnings amounted to £2 14s. a week. It was said that the custom was that where there was no work there should be no pay, but the whole question was whether the Munitions of War Acts had imported a term as to notice into the agreement, and whether the term having been so imported the plaintiff could sue for a breach of the term in the County Court. On May 3rd a section of the men, about 117, of whom the plaintiff was not one, went out on strike. In consequence of that action on the part of the men, the employers, rightly or wrongly, stopped the whole of the work. The County Court Judge found that the defendants were wrong in not providing plaintiff with work. The man was not dismissed; he remained in the defendants' employment ready for work. His contention was that the Judge wrongly construed the Acts of Parliament, and that plaintiff was not entitled to judgment.

MR. CYRIL ATKINSON, K.C., for the respondent, contended that the real question brought before the judge was whether the terms of employment were varied by the Acts of Parliament; but it was not admitted by the plaintiff that when there was no work there should be no pay. The only thing admitted was that if before the passing of the Munitions Act there was no work there should be no pay, but after the passing of the Act he was entitled to a week's notice. *Prima facie*, an employer was bound to find work for his servant, but an employer might get away from that duty by proving custom in the trade that if there was no work there should be no pay. Under the Act a man could not leave his employment without notice, and on the other hand, it was provided that notice of dismissal should be given by the employer.

MR. JUSTICE SHEARMAN, in giving judgment, said that the County Court Judge had held that the Act of Parliament had imported the term as to notice into the contract, but even if it was so imported, the Act appointed a special tribunal to deal with the matter. In his opinion the County Court Judge was wrong in holding that it was so imported by the Act and the plaintiff was right in his contention that the only tribunal by whom the matter could be decided was the Munitions Tribunal. The plaintiff had brought his action in the wrong Court, and on that ground the appeal must be allowed, with costs.

MR. JUSTICE SANKEY concurred.

MR. CYRIL ATKINSON asked for leave to appeal, as many other workmen were affected by the judgment.

MR. JUSTICE SHEARMAN said that he (Mr. Atkinson) would have to go to the Court of Appeal for leave to appeal.

HARRIS *v.* HINDS.

IN the King's Bench Division, on June 19th, Mr. Justice Coleridge had before him an action in which Mr. Thos. Harris, now trading as Albert Lee & Co., and Albert Lee & Co., Ltd., of 2 and 3, New Zealand Avenue, E.C., claimed from J. H. Hinds & Co., of 6, Eldon Street, London, the sum of £158 paid to defendants for electric batteries which were alleged to be defective and useless, and damages for alleged breach of contract.

Defendants paid £20 into Court in respect of a number of batteries in question, and, in respect of the remainder, denied that they were defective and useless, as alleged.

Mr. J. B. Matthews, K.C., and Mr. Thorpe appeared for the plaintiffs, and Mr. Langdon, K.C., with Mr. Wallington for the defendants.

MR. MATTHEWS, in opening, explained that the reason there were two plaintiffs was that Mr. Harris converted his business into a company, which was incorporated in May, 1916, and it was doubtful whether some of the damages accrued to Mr. Harris before his assignment of the assets to the company. Before the formation of the company Mr. Harris carried on business at 28 and 29, London Wall. The defendants were in normal times, said counsel, clock and watch manufacturers, but they also had dealings in electric batteries and refills. The plaintiffs bought from the defendants a large number of these batteries upon a warranty that they had a certain period of life—that was life after they had been on the shelf. Four months was the period during which they were supposed to retain their full lighting power. Plaintiffs' case was that the warranty ran from the time at which the goods were delivered to them. Plaintiffs were middlemen selling to retailers, and the defendants were not themselves the manufacturers of the articles, but they sold direct in their name and were personally liable on the contract. They got the goods from the Inter-State Electric Novelty Co. of the United States. Plaintiffs' order was given on February 15th for 20,000 No. 920 electric torches. On March 1st, Mr. Pott, acting for the defendants, called upon the plaintiffs, and said there had just arrived in England 9,000 of a kind exactly similar to the 20,000 ordered, and asked if they would take immediate delivery of that consignment. This was agreed to, the price being 5s. 3d. a dozen plus the shipping charges. The 9,000 duly came to hand, but as they were in advance of what the plaintiffs required for their business, the cases were not at once broken open. When plaintiffs did break open the cases, they found that some of the batteries were sweating, which was the first symptom of decay. When they came to test them, they found that they were defective and wholly useless for the purpose. The three-cell batteries, which should have shown a voltage of 4·5, were below 4, and the two-cell batteries, which should have shown a voltage of 3, were below 2·5, while a large number showed no voltage at all. Plaintiffs were unable to state the precise number which showed no voltage, but there were many. They had paid in respect of the goods £176 7s. 5d., and for shipping charges £17 12s. 9d., and for cartage and labour £2 10s.—amounting in all to £196 10s. 2d. They telephoned to the defendants, and told them that the goods were of no use and that they must take them back. They were doing a tremendous business in these things at the time, and they could get no satisfaction.

In reply to the Judge, Mr. Matthews said that the goods were not actually sent back, as plaintiffs were anxious to keep on good terms, and the matter was not one of urgency. Defendants said they would communicate with their people across the water, but he (counsel) contended they had rejected the goods legally. He pointed out that the defendants had admitted liability regarding some of the batteries by paying £20 4s. into Court, and he asked his Lordship to judge of the character of the whole of the goods "by the company they had kept." As to the claim of the plaintiffs for damages, he said there was a "roaring" sale for these goods, and plaintiffs had lost the profit they would have made on the sale to retailers. In respect of that they claimed £65, which worked out at 33⅓.

Before counsel had concluded his opening statement, it was announced that the case had come to an unexpected termination, as the parties had arrived at a settlement. He handed a note to the Judge, and stated that the parties would resume business together.

The action thus terminated, the terms of settlement not being announced.

WAR ITEMS.

Exports to Switzerland: Prohibition.—The "London Gazette" for June 25th contains a lengthy proclamation relating to the prohibition of exportation of certain articles from the United Kingdom to Switzerland.

Uruguay.—The "Review of the River Plate" contains the following paragraph:—"The Government has instructed the National Office for the Inspection of Banks to intervene in all operations carried out by the 'Transatlántica' Tramway Co., with the object of preventing that company carrying on any commercial transactions with firms whose names appear in the 'Statutory List.'"

League of German Electricity Supply Undertakings.—The *Vossische Zeitung* of May 23rd, in reporting briefly the third annual meeting of the League of Electricity Supply Undertakings of Germany, states that the League now includes all companies of any importance in the domain of electricity supply and finance. In the affiliated concerns about 2¾ milliards of capital are invested.—*Board of Trade Journal.*

Bolting the Door Against Bosch.—With reference to our paragraph under this heading last week, we understand that news has been received that the Australian Government has prohibited the importation into Australia of American-made Bosch magnetos. The High Commissioner of the Commonwealth, in a letter announcing this fact, says that "this action has been taken in order that the Commonwealth may not be a party to maintaining German trade names for the ultimate benefit of German manufacturers after the war."

Strike at Mülheim.—The "Times" correspondent at the Hague says that an extensive strike broke out on Thursday last week at Mülheim, near Cologne, at "a former cable factory which is now a munitions works." About 20,000 workers struck. Trouble had been brewing for some time, but the reduction of the rations was the last straw.

Tramway and Electricity Managers and Military Service.—By an arrangement between the Local Government Board and Sir Auckland Geddes, the managers, of the new military age, of municipal electricity works and tramways are not at present to be called up for medical examination, but this arrangement is subject to reconsideration at the end of three months.

Machine Tools and Woodworking Machines.—A circular letter has been addressed by the Ministry of Munitions to all controlled establishments pointing out that it is an offence under Regulation 30A of the Defence of the Realm Regulations for any person to buy or sell a machine tool or woodworking machine without the permission of the Ministry, even although such tool or machine may be described as "scrap," and stating that in view of the fact that it has been brought to the notice of the Ministry that in certain cases machines have been bought and sold as "scrap" in contravention of the regulations, those regulations in future will be rigidly enforced.

The Machine Tool Department, Charing Cross Buildings, Embankment, must be notified of any machine tools or woodworking machines alleged to be "scrap" which a firm may have for disposal, so that inspection can be made on behalf of the Ministry. The firm will be informed as soon as possible after an inspection has been made whether the machine tools in question have been classified as "scrap" or as "serviceable" machines.

If the machine is classified as "scrap" the fact will be notified by the Ferrous Scrap Department, Whitehall Place, S.W. 1, and such "scrap" machine may only be disposed of in accordance with the instructions received from that Department.

If the machine is classified as a "serviceable" machine the fact will be notified by the Department of Engineering (Central Clearing House Section), and the machine will in that event be placed on the list of second-hand machines available for transfer kept by the Ministry, and notification of its ultimate disposal will be sent by the Machine Tool Department of the Ministry.

German Stocks in Neutral Countries.—A member of the House of Commons last week asked the President of the Board of Trade whether he had any official information showing that Germany was having goods manufactured in neutral countries with a view to exporting them to the United Kingdom as neutral goods at the conclusion of the war, and that large quantities of raw materials were actually held in England to-day occupying store space and ready to be shipped to neutral countries for manufacture directly there was a chance of export; and, if so, whether any of these goods were German owned and were transferred to neutral nominees at the commencement of the war. In reply, Sir Albert Stanley said that he had no official information to the effect stated, but he would be glad to consider any evidence as to the storage of goods on foreign account in this country. The Imports and Exports (Temporary Control) Bill, when it became law, would provide the necessary machinery for carrying out, after the war, any policy regarding the control of imports and exports which might be decided upon.

Exemption Applications.—At the Wakefield Local Tribunal, the Wakefield Tramway Co. appealed for the exemption of one of their drivers (44), Grade 1, a man with eight children. The company contended that the man was doing work of national importance. He was such a safe driver that he was entrusted with the teaching of discharged soldiers and new men. He was no "slacker," as during the past six months he had averaged 68 hours a week on tramway work, and, in addition, in his spare time he put in 25 hours a week for a market gardener, as well as cultivating two allotments of his own. Six months' exemption was given, together with exemption from drill.

At Warrington, the Infirmary Board of Management appealed for an employé (30, Class A) who is in charge of the electric light installation, fruitless efforts having been made to secure a substitute. The appeal was refused, with two months' grace.

The Halifax Tribunal has withdrawn exemption held by G. Thomas (41, Grade 1), a machinist engaged on the Halifax tramways. W. R. Shepherd (43, Class A), in charge of the coal-conveying plant at the Corporation electricity works, has been given final exemption until August 15th.

The West Ward (Cumberland) Tribunal has refused exemption to T. Martin (Grade 1), electrician, applied for by Miss Noble, C.C., Beckfoot, Bampton.

At Windermere, the Electricity Supply Co. appealed for J. Reid (32, Grade 2), the only competent engineer left on the staff, and temporary exemption until September 30th was given.

At Hastings, appeals for J. Willard and G. Brett, employés of the Tramway Co., were adjourned until they are called up, they being in an exempted occupation.

At Bath, appeals filed by the National Service Representative against W. G. C. Adams (31, Grade 1), chief clerk and cashier, and W. J. Targett (34, Grade 1), engineering fitter, with the Bath Tramways, Ltd., were withdrawn, both having received exemption certificates from the Ministry of Munitions.

The West Kent Appeal Court has granted three months for substitution to E. Croucher (33), C. F. Hayter (30), S. W. A. Mercer (29), F. Ralph (26), and S. A. Sharpe (31), all in Grade 1, motormen with the Chatham & District Tramway Co.

Before the West Kent Appeal Court, exemption was claimed by J. E. Freathy (43, Grade 2), chairman of the Gillingham Corporation Electric Light Committee, and formerly the National Service Representative for the borough. The Town Clerk said that as chairman of the Electric Light Committee Mr. Freathy was enabled, owing to the technical knowledge he possessed, to render considerable assistance at the works in the evening; he was, in fact, doing the work of a skilled man. On the Court dismissing the appeal as from July 31st, the Clerk pointed out that that would put Mr. Freathy in a worse position, as the local tribunal gave him two months. The Chairman: Then we will dismiss the appeal, and the order of the local tribunal stands.

At Salisbury, exemption was sought for an electrical installation attendant at an estate at Alderbury, aged 44, and in Grade 1. It was stated that the man had charge of two large 40-H.P. suction gas plant engines, which supplied the whole motive power for the estate machinery, and he had had care of the electric plant since it was installed 11 years ago. On the appeal being opposed by the National Service Representative, the chairman said that skilled electrical engineers were extremely difficult to find at the present time, and the Isolation Hospital Committee had found it impossible to get one. The Tribunal considered that the man was absolutely essential in his present position, and gave exemption until September 1st. Notice of appeal was intimated.

Exemption until September 30th has been granted to C. H. Lewis (44, Grade 1), secretary to the Leominster Electric Light Co., Ltd.

On the application of the National Service Representative, a protection certificate held by S. Knowles (37, Grade 1), secretary to the Bishop Stortford and Epping Gas & Electricity Co., has been withdrawn.

BUSINESS NOTES.

Competition in Electrical Trade in China.—The issue of the *Japan Advertiser* for April 5th states that "with the arrival of a party of Chinese business men and newspaper men in Tokio to-day, in compliance with the invitation from the Electrical Exhibition at Uyeno Park, the real motive of the men planning this show has been revealed; and it is clearly known that Japanese electrical engineers have an ambitious scheme of replacing the German electricians in the market in China and, after the war, trying to contest that big commercial theatre with American and British engineers." The Chinese party was to visit various electrical engineering works, and also the electrical laboratories of the Department of Communications, of the Imperial University, and some technical schools, where scientific and industrial research is being carried on. Japan has supplied China with electric lamps, wires and cables through establishments at Shanghai. The latest of them, the China Industrial Development Co., has also the supply of these goods in sight. In a recent report, H.M. Commercial Attaché at Yokohama stated that the manufacture of electrical machinery and appliances in Japan had undergone great development since the first electrical industry was established some 30 years ago. The object of the Tokio Exhibition referred to above was to demonstrate the progress that had been made. The exhibits appear to have covered a fairly wide range of goods; they were divided into six sections—domestic appliances, electrochemical industry, electric transmission apparatus (two sections), and electrical engineering, machinery, &c. (two sections).—*Board of Trade Journal.*

Manufacture of Electric Lamps in India?—*Indian Engineering* of June 18th, in referring to the enormous increase in the manufacture of electric lamps in Japan, says:—

"Compare this enterprise with India; why is it that India has not started her own manufacture of such an essential, and at the same time practically standardised, article? The present extra cost resulting from freight, breakages, and special packing for export would go considerably towards paying the interest on any capital expenditure incurred in starting a manufactory in the country."

French Commercial Bureau in London.—An "Office Commercial Français en Angleterre," under the auspices of the French Chamber of Commerce in London and subject to the control of the French Ministries of Commerce and Foreign Affairs, represented by the Commercial Attaché to the French Embassy in London, has been formed, having for its object the establishment and development by all means of commercial relations between French producers and British buyers, and the promotion of the sale of French goods in the United Kingdom.

According to the *Board of Trade Journal*, among the methods to be employed will be the holding at least four times a year of a Samples Exhibition of French products. These will last for about a fortnight, and will be opened, by invitation, to French, British, and Allied firms likely to be interested, and, during the last days of each exhibition, to the general public. The first of these exhibitions will not be held before the beginning of October next.

Further particulars may be obtained from the Office Commercial Français en Angleterre, 153, Queen Victoria Street, E.C. 4.

Patent Restorations.—Orders have been issued restoring the following patents:—James Todd, "Improved fastenings for smoke-box doors of tubular boilers, or the like," No. 15,593, of 1909; H. T. Williams and L. Wirtz, "Improvements in change-speed and in change-speed and reverse gears," No. 22,172, of 1912.

Sale of Electrical Cables in Australia.—The Department of Trade and Customs has decided to regard the use of the letters "C.M.A." on the labels attached to imported wires and cables as an indication that the manufacturers of the goods are associated with the British Cable-Makers' Association, and that the goods have been manufactured in accordance with the specifications of the Association. The use of the word "Association" when unqualified is also to be regarded as having similar implications. The Department has also decided that statements such as the following:

> "Guaranteed equal in all respects to 'C.M.A.' product of similar grade,"

may be used on wires and cables manufactured by non-members of the British Cable-Makers' Association, provided the goods are thereby correctly described.

In reply to a suggestion that, in addition to the foregoing, the maker's name and country of origin should also be distinctly stated on the label, the Department point out that there is no power under the "Commerce (Trade Descriptions) Act, 1905," to require the name of the manufacturer to be marked on imported wires and cables. A statement of the country of origin is, of course, required to be marked in conjunction with any English wording applied to any goods made in a country where English is not the ordinary language used, and which are imported into the Commonwealth.

H.M. Trade Commissioner will report in due course whether any testing arrangements are being devised by the Department of Customs and Trade, to ensure that goods imported by non-members of the Cable-Makers' Association are correctly described.—*Board of Trade Journal.*

Book Notices.—"*The Electrician* Annual Tables of Electricity Undertakings of the United Kingdom, the Colonies, and Foreign Countries." London: Benn Bros., Ltd. 1918. Price 5s. net.—Hitherto these tables have been issued from time to time in *The Electrician* in the early months of the year. They are now being published separately in one cover annually on May 1st. The present issue contains the accounts and particulars of British electricity supply undertakings; electricity supply schemes projected; prov. orders undeveloped; British electrical power companies; Colonial, Russian, and foreign electricity supply works; Colonial and foreign electric railways and tramways; and electricity supply works in the Argentine.

"Bulletin of the Bureau of Standards." Vol. 14, No. 1, contains the following:—Determination of Degree of Uniformity of Bars for Magnetic Standards; Thermo-electric Measurement of Critical Ranges of Pure Iron; a Study of Electromagnet Moving-Coil Galvanometers for Use in Alternating-Current Measurements; Standard Substances for the Calibration of Viscometers; an "Average Eye" for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality-of-Brightness Photometer; Emissivity of Straight and Helical Filaments of Tungsten, &c. Washington: Government Printing Office. Price 25c.

Japanese Electrical Machinery and Fittings in India.—Special efforts are at present being made to introduce electrical machinery and fittings of Japanese manufacture into India. One concern, the Mitsui Bussan Kaisha, Ltd., of Tokio, has now established an office in Calcutta for the purpose.

Liquidations.—A.E.G. Electric Co., Ltd.—A petition by the Board of Trade for the winding up of this company is to be heard on July 2nd.

Technical Engineering Co., Ltd.—Meeting called for July 23rd at 2, Bixteth Street, Liverpool, to hear an account of the winding up.

J. T. Pickering Hoist and Engineering Co., Ltd.—Meeting July 27th, at Nottingham, to hear an account of the winding up from the Liquidator, Mr. S. B. Saunders.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Bolton.—The adjourned examination of this debtor took place at Bolton on June 19th, when the Official Receiver stated that the creditors' meeting stood adjourned to enable the debtor to formulate a proposition which he hoped would be to the advantage of the creditors. He was developing certain inventions which it was not necessary to particularise. The Receiver asked for an adjournment of the examination until after the creditors' meeting. Adjourned.

Trade Announcements. — Messrs. Thermit, Ltd., 675, Commercial Road, London, E., inform us that the whole of the company's shares, which in August, 1916, were sold by the Public Trustee to the Birmingham Metal and Munitions Co., Ltd., have now been taken into their own holding by Nobel's Explosives Co., Ltd., Glasgow, and under the new auspices the activities of Thermit, Ltd., are being considerably extended.

Owing to war conditions, Messrs. Graham & Latham are closing down their showrooms and offices at 104, Victoria Street, S.W., and transferring the head office to the works at Cremorne Wharf, 27, Lots Road, Chelsea, S.W. 10. As from 30th inst., communications should be sent to the latter address. Telephone No.: "Kensington 3761."

Lists.—The Hillbar Press, 76, Finsbury Pavement, London, E.C. 2.—Priced circulars illustrating their soldering irons, dolly-making machines, and other appliances for the dry battery trade.

Unfenced Machinery. — According the *Times*, the Pirelli-General Cable Works, Ltd., were fined £25 at Southampton, on Tuesday, for having some unfenced machinery through which a female employé met with an accident and lost an arm.

Moonlight Charts.—Messrs. C. A. Vandervell & Co., Ltd., have issued their moonlight charts for July.

LIGHTING AND POWER NOTES.

Australia.—Tasmania.—A curious situation has arisen at Hobart. In December, 1915, the manager of the State electricity supply undertaking, Mr. J. H. Butters, issued a circular urging consumers to make every possible use of electrical energy, which was derived from water power, so that the revenue would be increased and a deficit avoided; the promise was also made that the price would be reduced as the consumption increased. Now, however, the price has been increased, because the demand is so great that the steam plant has had to be brought into use! The war is blamed for the shortage of pipes, resulting in insufficient capacity of the hydro-electric plant.—*Hobart Mercury.*

Barnes.—Bulk Supply.—The Lighting Committee reported that it had considered the question whether it would be more advantageous to obtain a supply of electricity from the London and South-Western Railway than to provide for an additional supply by extending the works and installing new plant, and recommended that the scheme for obtaining the supply on suitable terms from the railway company be proceeded with, and that the engineer should continue negotiations with the Director of Electrical Power Supplies.

Bexhill.—Year's Work.—The gross profit on the Corporation's undertaking during the past year was £5,602. After payment of loan charges, &c., there is a net profit of £197. Working expenses have increased on account of the cost of materials and some adjustment to wages, but the increase of revenue due to the expansion of the business has been sufficient to meet the extra cost. The working cost per unit has again dropped by ·09d. The result of the year ending March, 1917, was a deficit of £284.

The 12½ per cent. Award.—The Council has agreed to accept the award of 12½ per cent. for electrical workers as applied to the employés of the electric light undertaking.

Bury.—Price Increase.—The Corporation Electricity Committee is increasing the charges for electricity for lighting, power, and heating, as from July 1st, by adding a further 10 per cent. to each account.

Continental.—France.—A special Commission appointed last year to compare and report upon the various projects for the use of the hydraulic energy of the Rhone has recently decided to recommend the abandonment of the proposed construction of a dam near Pont de Grésin, about 12 miles from the Franco-Swiss frontier, and of another near Malpurtuis, in favour of a scheme which provides for the erection of a hydraulic power station at Génissiat, about 4½ miles south of Bellegarde. By the dam at Génissiat, with a height of about 250 ft. and a fall ranging from 201 ft. to 226·3 ft., a total of 240,000 h.p. is provided for. By means of the proposed works a reservoir would be formed by the river, when in high flood. This reservoir would be about 14¼ miles in length, reaching almost to the Franco-Swiss frontier, with a superficial area of some 940 acres, and a summit level of 1,089 ft. above the sea.

With a view to developing certain waterfalls which it has in reserve, the Société Générale de Force et de Lumière, of Grenoble, has decided to increase its capital from 18,000,000 francs to 30,000,000 francs.

Under the style of L'Energie Electrique Rhône et Jura, a company has been formed to utilise a fall on the River Ain and build a hydro-electric station at Bolozon, Arrondissement of Nantua.

The Compagnie Electrique de la Loire et du Centre is taking steps to utilise the falls at Besbre, estimated to supply some 30,000,000 kw.-hours a year. The energy will be transmitted to Roanne and supplied to the arsenal there through the Chatel Montagne and Yourdiat stations.

Works for the manufacture of a new iron alloy are in course of construction by the Société Electro-Chemique du Giffre (Upper Savoy), a new company formed for this purpose.

In connection with the development of Bassens, on the Gironde, about 1 kilometre above Bordeaux, as a seaport, it has been decided to erect a steam-driven electric power station to work the goods-handling plant, part of which latter has already been ordered in the United Kingdom. The scheme is intended to relieve the congestion of traffic which exists at Bordeaux.

Italy.—The Higher Council of Waters has declared itself in favour of admitting for examination a scheme for certain hydro-electric developments in Sicily. The scheme includes the formation of two artificial lakes, one on the Flascio torrent, and the other on the Alcantara torrent, at about 1,135 metres above sea level. A total of 30,000,000 cb. metres of water would be stored and utilised by means of these artificial lakes. This electric plant would stimulate the industrialisation of the districts between Catania and Messina, and would render the electrification of the Catania-Palermo railway possible. Above all, the water which was formerly wasted during the floods would be available during the dry season for irrigation. This is the first instance of artificial lakes on a large scale carried out in Sicily.—*Board of Trade Journal.*

Russia.—According to the *Zeit* of April 20th, the National Economic Council has undertaken the erection of electric power stations in order to utilise the water-powers of various rivers. The power obtained is expected to provide all the Petrograd industries with electricity. A special station for Petrograd alone is to be erected on the Velkhov. The line voltage has been fixed at 60,000 volts.

Spain.—It is announced that a company has been formed to exploit the falls of the Douro River, which are 300 ft. high, and are estimated to be capable of developing 350,000 H.P. The capital of the company is entirely Spanish, and amounts to £6,000,000. The power developed will be conducted to Madrid, Bilbao, and throughout Galicia; the enterprise is expected to hasten the electrification of the railways throughout the north and east of Spain.

A draft scheme has been laid before the Cortes to authorise the Government to arrange with the Compania de los Ferrocarriles del Norte for the immediate installation of electric traction on the slope of the Pagares and on the Leon to Gijon line, and for the necessary widening works on the same line and on that of the Venta de Banos to Leon railway, to meet the increased coal traffic on the Pampas section, estimated, a year from the completion of the works, at 1,500,000 tons per year. The scheme will be subsidised by the Government.—*Industria e Invenciones.*

Sweden.—What are claimed to be the world's largest generators for water power are being built in Sweden by the Almänna Svenska Elektriska Aktiebolaget in the works at Västeras. The generators, of which two have been ordered by the "Glomfjord," Ltd., in Norway, will have an output of 22,000 K.V.A. at 300 R.P.M., and 15,000 volts. The stators are built in four pieces, and have a weight of 100 tons each, not including the windings.

Austria.—The Austrian Government has drafted a plan for the development of the hydro-electric resources of the country, the eventual object being the electrification of the principal railway networks. According to estimates the hydraulic resources of the Austrian Alps total 3,000,000 H.P., of which only 3 per cent. is now utilised.

Dundalk.—Year's Working.—The annual statement of accounts for the year ended March 31st, 1918, shows £9,345 total revenue; total expenditure, £5,353; gross profit, £3,992; interest, £1,331; sinking fund, £2,290; net profit, £370: as compared with a deficit of £1,177 the previous year. During the year 790,962 units of electricity were sold; total average works costs per unit sold, 1·621d.; total all-in costs, 2·720d.; average price obtained per unit sold, 3·529d.: total maximum demand, 506 KW.; load factor, 17·9 per cent. Mr. Spalding, the electrical engineer, reports that since July 17th tar oil has been used exclusively as the main fuel on all the Diesel engines. The adaptation of the five engines to burn tar oil involved a capital outlay of £950, towards which the Great Northern Railway Co. of Ireland, Ltd., contributed £400 in respect of two new engines. The cost of tar oil is 83s. per ton, as against 180s. per ton for crude oil, the rate of consumption being about 350 tons.

Dundee.—Year's Working and Price Increase.—At the last meeting of the T.C., in submitting the accounts and estimates, it was stated that the income last year was £103,213, and the balance, after paying all outgoings, was £295. There was an increase of revenue of £27,000, due to increased charges and also to an increase of 15 per cent. in the number of units sold. It was estimated that generation costs this year would be increased by £8,000, while there would also be a reduction in the number of units sold as a result of the Daylight Saving Act and other causes. Mr. Hynd, the convener of the Electricity Committee, said that the new charges for electricity for lighting would work out at an increase of from ¾d. to ⅛d. per unit, according to the class, the highest class being 5d. per unit; while for power the charge for the first 10,000 units would be 2¼d. per unit, instead of 1⅞d. The charges for subsequent quantities would remain as at present, and there would be no change in the charges for the tramways. The lighting charges were now from 43 to 46 per cent. higher than the pre-war rates. For power the increase on pre-war rates was for the first 50,000 units 50 per cent. and over that quantity 100 per cent. The proposals were agreed to.

Ebbw Vale.—Utilisation of Waste Gases.—The chairman (Sir Chas. Allen) stated at the ordinary general meeting of the Ebbw Vale Steel, Iron, and Coal Co., Ltd., that the company now has, owing to large extensions to its blast furnace, coke oven, and by-product plant, large volumes of waste gases which are to be turned to profitable account. Sufficient electric power is thereby to be generated to enable the company to electrify the whole of its property, not only the iron and steel works, but also the collieries in Ebbw Vale and the adjoining valleys. Work is now in hand, and nearly completed, which will connect its newly-acquired coal properties with its central power station at Ebbw Vale, so that these mines, situated several miles distant, will derive their power from the waste gases available from the production of iron and coke.

Electricity Supply Charges.—The Board of Trade intends to introduce a Bill to give effect to the recommendations of the Select Committee on Gas Undertakings, and to include in the Bill provisions of a like nature in respect of electricity undertakings.

Great Harwood.—The U.D.C. has decided to apply for a renewal of the Electric Lighting Order.

Hornsey.—Year's Working.—There is a loss of £2,006 on the working of the Council's electricity undertaking for the past 12 months.

Hull.—The acting engineer (Mr. McGoris), in referring to the shortage of plant, stated that the Electricity Committee was desirous of erecting steel steam and smoke stacks, but had been unable to obtain permission at present. It was agreed to give the employés double pay in lieu of the annual holiday, which could not be arranged this year owing to shortage of staff.

Ipswich.—Loan Application.—The Electric Supply and Tramways Committee reported that the need for additional electrical generating plant at the power station had become urgent. The Committee had been in consultation with the Government Department concerned upon the matter, and now had an intimation from the Ministry that the proposals put forward were approved, and that the necessary permit and priority would be issued for the manufacture of what was covered by the estimate, totalling £43,000. The Committee considered that on the basis of the output for the past year the saving in coal by the new plant would be from £5,500 to £7,300, while the reduced consumption of water, oil, &c., and fewer repairs, should result in a further saving of from £500 to £600; the annual capital charges including amortisation would be about £4,300. The Committee, therefore, recommended that application be made to the L.G.B. for sanction to the borrowing of £43,000.

Year's Working.—The report of the year's working shows a surplus of £2,174, of which an amount of £473 was expropriated to the liquidation of the adverse balance brought forward from the previous year, a sum of £118 went to cover certain capital expenditure (wages of permanent employés), which, under the rules of the L.G.B., must be defrayed out of revenue, and the remainder (£1,583) was transferred to reserve or renewals account. The sum of £1,134 has been received during the year from the General District Rate towards a sum to serve as working capital for the undertaking; the total sum now in hand amounts to £5,262.—*East Anglian Times.*

Leeds.—Year's Working.—The annual report of the working of the electricity undertaking for the year ended March 31st shows total units sold 62,771,883, an increase of 7,779,141, or 17 per cent., 46,861,408 units being for power purposes, as compared with 40,143,880 in the previous year. The aggregate capacity of the motors connected has grown from 48,513 to 54,743 H.P., the consumption of electricity for lighting purposes indicates a recovery from the falling off induced by daylight saving and other measures, the units sold to private consumers having increased from 6,264,784 to 6,759,581, or 8 per cent. The number of consumers using electricity for heating purposes through separate meters has increased from 1,288 to 1,502, and the total capacity of the apparatus connected to such meters has increased by 30 per cent., the units registered totalling 1,169,082, as compared with 951,358, or 20 per cent.; the total number of consumers taking current on the rateable system of charging for private residences has increased by 26 per cent., and the units sold to such consumers by 37 per cent. The total cost of production per unit sold was 1·01d., as compared with ·98d. in 1917. The total all-in costs were 1·04d., and the average price obtained per unit sold was 1·04d. The maximum load was 24,920 KW., the present plant capacity being 41,800 KW. The 12,000-KW. turbo-alternator ordered in 1914 became available for use near the end of the period under review. The total revenue was £271,595; working expenses, £135,484; gross profit, £136,111; war allowance, £1,199; income-tax and interest, £47,237; sinking fund and special charges, £78,004; contributions to capital expenditure, £9,391; surplus profit £277, as compared with £4,161 surplus in 1917. During the year two engines and alternators, with a capacity of 1,400 KW. each, have been discarded and sold, and a contract entered into for a 6,000-KW. turbo-alternator, to be erected on the site of the discarded plant, representing a considerable saving of space and a prospective saving in coal consumption, the year's revenue being charged with £9,497 incidental to the discarding and replacement of the above plant. The reserve fund now amounts to £17,762.

Llandudno.—Price Revision.—In January last the Urban Council decided to notify the Light Railway Co. of its intention to discontinue the supply of energy for traction purposes at the end of the year, as the price paid under the agreement has entailed a loss owing to the increased cost of fuel, &c. In reply, the secretary to the Railway Co. has inquired whether the Council has any suggestion to make before the company proceeded to arrange for an alternate supply. A sliding scale of charges has now been submitted based on the price of coal, and it is hoped this may form the basis of an agreement. The Council suggested to the Railway Co. that the agreement for the supply of energy should be renewed, subject to the addition of the following sliding scale of charges, based on the cost of fuel :—That, in respect of all units consumed in any one year, no variation be made in the existing schedule of prices until after coal reaches 12s. a ton. When the purchase price of coal in any one year exceeds 12s. a ton and up to and including 13s. per ton, the price shall be increased by 0·05d. per unit ; thereafter, that the price shall be increased by an additional 0·05d. per ton for each complete additional 1s. per ton. During the past year the price of coal has been about 19s. a ton.

Annual Accounts.—The report of the year's working of the Council's electricity undertaking to March 31st last shows total income £11,463 and a total expenditure of £13,189, leaving a deficiency of £1,726 ; included in the expenditure was £50 for professional charges for the special report upon the undertaking prepared by Mr. Patchell. Last year the deficiency was £1,660, which was met out of the rates ; this year the Electricity Committee recommended that the deficit be met by a contribution of £1,000 from the rates and £726 from the reserve fund.

London.—Poplar.—Annual Report.—The total net profit on the working of the electricity department to March 31st last is £7,553 ; deducting £2,625 in respect of capital expenditure paid out of revenue, reduction of loans on account of services, and contributions to superannuations and pensions fund, leaves £4,928 available for distribution, which it is recommended shall be allocated as follows : At disposal of Finance Committee, £1,946 ; bonus to staff, £1,034 ; reduction of assets, £1,946.

The Electricity Committee recommends that the underfeed stokers of No. 11 boiler be fitted with a new type of chain-grate capable of burning breeze, coke, or anthracite coal, at an estimated cost of £3,000.

The Committee reports that a draft agreement has been settled with Stepney eliminating stand-by and bulk supplies which are not now necessary, and defining "light load" and "heavy load" periods, each party to reciprocate any supplies taken during any quarter. Cost of fuel has been the basis of the change, and it is proposed to include handling up to actual delivery into bunkers, testing for calorific value, and disposal of ashes. In the event of breakdown and the necessity to supply during heavy load, the receiving party to pay an additional 50 per cent.

Chelsea.—Cable Explosion.—The underground property of the Chelsea Electric Supply Co., Ltd., and the Borough Council, in Flood Street, was considerably damaged on Sunday night as the result of an explosion. A considerable length of cable was destroyed, two distributing boxes, six telephone junction boxes, and 30 ft. by 25 ft. of the pavement were damaged by fire and breakage. Rose Coward was injured, and had to be removed to hospital.

Nelson.—War Wages.—The T.C. has approved a recommendation that the war wage increase of 16s. per week paid to the employés in the electricity and tramway department be increased to £1 per week as from the first full pay-day after March 8th, subject to any exceptions for special reasons.

Pontypridd.—Price Increase.—The Electricity and Tramways Committee has decided to increase the charges for electrical energy for lighting, power, heating, and cooking purposes by 10 per cent.

Power Co.'s Bill.—The Yorkshire Electric Power Co.'s Bill, which has already passed the House of Lords, was read a third time in the House of Commons last week.

South Wales.—The Board of Trade has extended the Cowbridge and Pennybont Electric Light Order of 1914 of the South Wales Electrical Power Distribution Co. for one year.

Tonbridge.—The U.D.C. has purchased the Old Town Mill, fitted with a 20-h.p. water-wheel, with adjacent property, for £3,250. The electrical engineer (Mr. Plunkett) estimates the value of the wheel for producing energy at £300 a year.

Weymouth.—Price Increase.—The T.C. has decided to increase the charges for energy as under, as from September 30th :—From 6½d. to 7d., from 5¾d. to 6½d., from 5¼d. to 6d., from 2¾d. to 3d., from 1¾d. to 2d., military supply increased to 5d., fixed-price lighting increased by 20 per cent. The engineer states that, through the Lighting Restriction Order, the undertaking will lose approximately £1,000.

TRAMWAY AND RAILWAY NOTES.

Electric Vehicle Progress.—An electrically-propelled platform barrow for the carriage of parcels has been adopted by the North-Eastern Railway Co., and during the past few days has been on trial at the Newcastle Central Station. The barrow is similar in size to the ordinary four-wheeled luggage carrier now in general use, and is capable of carrying 25 cwt. So far the barrow has proved entirely satisfactory, and the idea is to be introduced immediately at other important stations.

The Brush Terminal in New York uses 12,000,000 kw.-hours per annum for charging electric trucks alone. This figure gives some indication of the possibilities of this large and practical field for the use of electrical energy.

The following record of a 750-lb. electric truck used in ordinary city deliveries for 30 working days is furnished by the Electric Vehicle Section of the National Electric Light Association, New York :—

Days operated	30
Miles travelled	1,140·5
kw.-hours used	319·5
Number of miles per kw.-hour	3·57
Average energy consumption for one day	10·65 kw.-h.
Average run	38·01 miles.
Average merchandise load (overload of 250 lb.)	1,000 lb.
Energy cost per car-mile at 3 c. per kw.-h.	$·008
,, ,, ,, ,, at 4 c. per kw.-h.	·011
,, ,, ,, ,, at 5 c. per kw.-h.	·014
Maintenance (maximum estimate), including repairs and renewals of all mechanical and electrical parts, including tires, battery, and painting of wagon, should not exceed	$·04 per c.-mile.

Bingley.—Price Revision.—The District Council has appointed a deputation to meet the Bradford Corporation Tramways Committee in regard to the recent increased fares and with a view to securing an increased payment by the Corporation for energy supplied by the Council in the Bingley area of the tramways run from Bradford. The Council has also adopted a recommendation that charges to local consumers of electricity be revised.

Birmingham.—Night Service.—The Tramways Committee is unable to accede to the request of the local Trades Council to extend the time (11 p.m.) of running the last cars from the city owing to the necessity for economy in the use of electricity, in order to conserve coal supplies.

Cardiff.—Fare Revision.—Mr. A. Ellis, the manager of the Corporation tramways, reported as to the necessity for an increase in the tramway fares, and suggested that the fare stages should be left as at present, but that the face value of each ticket be increased by ½d. The minimum fare would then be 1½d. Workmen's fares after the the first two miles to be increased by ½d. The Lighting and Tramways Committee decided to adopt Mr. Ellis's proposals, and the recommendations will be placed before the City Council in July.

Edinburgh.—Experts' Report.—The Tramway Committee reported that the accounts rendered by Mr. J. B. Hamilton, Leeds, and Mr. J. L. Brodie, Liverpool, the experts who had reported on the whole question of the tramway system of the city, amounted to £693 in the case of Mr. Hamilton, and £610 in the case of Mr. Brodie. Mr. Harrison, convener of the Tramway Committee, said the report, which was obtained on the instructions of the Council, was a very important one, which, he believed, when they came to remodel their tramways, would settle the kind of traction to be used.

Galway.—Tramways for Sale.—Tenders were recently invited for the assets of the Galway and Salthill Tramways Co. as a going concern. The liquidator is Mr. Michael Crawley. It has been reported that some of the members of the Town Council are in favour of purchasing the undertaking, with a view to the electrification and extension of the tramways as early as practicable.

Glasgow.—Year's Work.—The annual statement of income and expenditure for the T.C. tramway undertaking shows :—Traffic receipts £1,404,110, against £1,245,507 in the previous year ; the Sunday receipts were £8,524, compared with £14,607 ; the respective totals being £1,412,635 and £1,260,115. In all items of expenditure increases are recorded, the figures for the year till May 31st, 1918, and that till May 31st, 1917, being respectively :—Traffic expenses, £527,152 and £395,736 ; general expenses, £156,949 and £137,816 ; maintenance and repairs, £179,811 and £143,758 ; power expenses, £86,019 and £67,231 ; Clydebank bridges, £1,131 and £879 ; allowances to employés on war service, £93,120 and £92,646 ; totals, £1,044,183 and £838,066 ; balance carried to net revenue account, £368,452 and £422,049 ; totals, £1,412,635 and £1,260,115. The net revenue account, including interest on investments, amounted to £377,031 against £500,687 last year, approximated for 1918 and 1917 respectively as under :—Rent of Paisley lines, £11,119 and £8,453 ; interest on capital, none and £78,846 ; sinking fund, none and £114,378 ; income-tax, £64,405 and £64,623 ; Parliamentary expenses, £61 and £98 ; renewal and depreciation, £123,894 and £73,305 ; totals, £199,479 and £339,702. The sinking fund has been cleared off, and the department is now a free asset.

London.—L.U.T. Bill.—The London United Tramway Co.'s Bill has been passed by the Select Committee appointed by the House of Lords after the second reading, and will be reported to the House. The scheme outlined in the Bill includes a drastic reduction of the capital ; an increase of fares ; postponement of the date and an alteration of the terms of purchase by the local authorities. The part of the company's undertaking inside the

L.C.C. area and its power station at Chiswick have been acquired by the L.C.C. Accumulated surplus revenue is by the clause agreed to last week to be applied to putting the system into good condition and repair.

Cars on the London United Tramways system ceased running for some time on Saturday evening last owing to a temporary breakdown at the Chiswick power station.

L.C.C.—Annual Estimates.—The Highways Committee has reported that the revised estimated revenue and expenditure of the Council's tramways for 1918-19 are as follows:—Total receipts, £3,321,750; total working expenses, including war-service allowances and £50,000 for contingencies, £2,593,140; leaving an estimated surplus of £728,610, which with interest, &c., £23,279, totals £751,889; sinking fund and repayment charges amount to £695,205 and income-tax to £44,569, leaving an estimated net surplus of £11,115 on the year's working instead of the original estimated deficiency of £205,290. The revised estimates are based on the assumption that the car-mileage during the year will be 50,000,000; the realisation of the estimates will depend on the maintenance of the necessary supply of power, on the necessary repairs to cars being effected, and a sufficient number of operatives being available. As regards the Government regulation requiring a reduction of 15 per cent. in the consumption of coal, the question of fuel economy has for a considerable time engaged the close attention of the Committee, and methods adopted for coal economy at the power stations by the partial substitution of coke locally produced have secured compliance with immediate Government requirements without reduction of the tramway services; as a further means of economising coal the Committee recommends the Council to approve a proposal for the grant of a bonus to motormen and conductors in respect of power which it will be possible to save if greater care is exercised in operating cars; the bonus to be 50 per cent. of the value of the direct saving on fuel due to decreased consumption of electrical energy.

The revised fares on the Council's tramways will come into operation on the lines in the east and north-east of London next Sunday and on the remaining northern services by July 17th.

Approximate Results for 1917-18.—The results of the year's working of the Council's tramways to March 31st last are estimated to show a net surplus of £62,009; the amount, when definitely ascertained, will be available for transfer to the renewals fund.

Scarborough.—Goods Traffic.—The Electric Tramways Co. proposes to carry fish on the tramways from the piers to the goods station, and the Government is to be asked to grant assistance toward the cost of laying the additional track.

Tramway and Vehicle Workers' Conference.—A Conference of the Amalgamated Association of Tramway and Vehicle Workers was held in Birmingham on May 28th. Referring to the affiliation with the National Transport Workers' Federation, Mr. E. H. Bawden, in a presidential address, said the Society by that act had attained a position of power and influence second to none in the country. He mentioned that they had applications pending for the extension of the 12½ per cent. to all tramway workers, and for bringing up the rates paid to women employés to a standard equal to that of the men. On the subject of Industrial Councils, the speaker pointed out that they would not serve with the Municipal Employés' Association, because it was felt that as they accepted employés eligible for membership of their Societies it was an unnecessary addition of trades.

The assistant secretary said the executive and headquarters were in sympathy with the effort to eliminate non-Unionists, but it was probable that that would be secured by the formation of Industrial Councils without their having any friction with any particular management. It would then have to be a condition of employment that employés must automatically become members of their Trade Union.

On the question of women drivers, the general secretary said that several interviews had taken place with the National Service Department officials; but the Executive of the Association had taken a definite stand on the matter, and decided that under no circumstances would it give permission for the employment of women as drivers of tramway cars. The National Service Department had promised to consider the question of placing the tramway industry in the list of protected occupations and of fixing an age limit.

Tramway Statutory Maximum Fares.—In reply to a question in the House of Commons, on Monday, as to what action the B. of T. proposed to take on the report of the Select Committee on Gas Undertakings (Statutory Prices), Sir Albert Stanley said he proposed to introduce a Bill as soon as possible to give effect to the recommendations of the Select Committee. The Bill would include provisions of a like nature in respect of tramway and electricity undertakings.

TELEGRAPH AND TELEPHONE NOTES.

High-Speed Wireless.—According to the *Telegraph and Telephone Age*, the Marconi Co. has applied the principle of Wheatstone transmission to radio-telegraphy. The signalling perforations are punched in ordinary Wheatstone tape, as in landline or cable signalling; the tape is then passed through a Wheatstone transmitter operated at the desired speed. The transmitter, instead of sending the signals directly to line, as in landline working, actuates a pneumatic engine, opening and closing air valves and releasing air under pressure provided by an air pump. Tubes are led from the pneumatic engine to signalling keys specially designed to break high-tension circuits. The extremely rapid movement of the pneumatically operated contacts makes it practicable to transmit signals at speeds exceeding 100 words per minute, without introducing troublesome arcing at contact points in the high-tension circuit.

Hull Telephones.—In order to meet the expenditure on war bonuses, &c., telephone rentals are to be increased. The annual report by the manager (Mr. Holme) states that the gross profit amounts to £18,933, compared with £22,747 last year, a decrease of £3,812, of which £2,400 is accounted for by additional war bonuses, and the balance by a decrease in revenue and increase in maintenance charges. The latter are higher due to increased cost of materials and the laying of a relief cable across the river, necessitated by the number of faulty lines east of the river. During the war there has been a net decrease of 1,500 instruments in service. When the transfer of the system to the Corporation took place it was estimated that there would be a net revenue of £5,300 per annum, after paying the interest and loan charges, and this was realised for the year ending March 31st, 1917. The accounts for the year ending March 31st, 1919, will show a considerable loss.—*E. Morning News.*

United States.—A resolution asking President Wilson to assume immediate control of the telegraph companies of the country, in view of the possibility of a strike of telegraphists, was passed by the American Federation of Labour.—*The Times.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Cavan.—The Clerk of the B. of G. having reported that the contractors in connection with the electric lighting installation had refused to sign the bonds, it was decided to re-advertise.

Dublin.—July 4th. Electricity Supply Committee. Coal-crushing plant. See "Official Notices" to-day.

London.—Fulham.—July 10th. Borough Council. Cables, ducts and accessories for the linking-up of the Fulham and Hammersmith Electricity Works. See "Official Notices" June 21st.

Morecambe.—Electric Light Committee. 2,000 tons of rough slack. See "Official Notices" June 21st.

New Zealand.—Wellington.—July 1st. Public Service Tender Board. 9,290 electric lamps (Indent No. 4,336). Some particulars may be consulted at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence) in London.

CLOSED.

Calcutta.—The Municipal Council recommends for acceptance the tender of the Russa Engineering Works, Ltd. (Henley's Wiring and Accessories) amounting to Rs. 11,494 for an electrical installation at the markets on the following conditions:—

That all wiring, lamps and fittings, necessary for the complete installation as tendered for, be delivered by the contractors to the Corporation Central Stores within one week of the acceptance of the tender.

That the contractors guarantee the wiring and accessories (excepting lamps and fans) for three years from the date of the completion of the work, and make good all defects arising during this period owing to faulty workmanship or defective material.

That the wiring work be subject to the approval of a responsible representative of W. T. Henley's Telegraph Works Co., Ltd.

Government Contracts.—List of new contracts placed in May, 1918:—

War Office.

Ebonite sheet and rod.—Siemens Bros. & Co., Ltd.
Electric lighting sets.—Day Motor Co., Ltd.; West Ham Corporation Electric Supply.
Generating sets.—Austin Motor Co. (1914), Ltd.; British Westinghouse E. & M. Co., Ltd.; Buffalo Forge Co., Ltd.; Electromotors, Ltd; Keighley Gas & Oil Engine Co., Ltd.; R. A. Lister & Co., Ltd.; Parsons Motor Co., Ltd.; Rhodes Motors, Ltd.; Siemens Bros. Dynamo Works, Ltd.
Motors, &c.—Crypto Electrical Co.; Electrical Apparatus Co., Ltd.; Electric Construction Co., Ltd.; F. Parkinson & Co.; Phœnix Dynamo Manufacturing Co., Ltd.
Switchboards.—Veritys, Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.
Trucks.—Edison Accumulators, Ltd.
Works services, electrical.—Pritchett & Gold and Electrical Power Storage Co., Ltd.

India Office.

Cells.—J. Stone & Co.

H.M. Office of Works.

Engineering services.—Electric wiring, Ministry of Pensions Buildings, Burtons Court, Chelsea.—S. Reed & Sons. Lift, National Physical Laboratory, Teddington.—Waygood-Otis, Ltd; Motor-generators, &c., National Physical Laboratory, Teddington.—Mather & Platt, Ltd.; Vickers, Ltd.: Electric wiring, National Physical Laboratory, Teddington.—T. Clarke & Co.; Switchboards, National Physical Laboratory, Teddington.—Ferguson, Pailin & Co.; Electric lighting and power wiring, Plymouth Grain Stores.—Alpha Manufacturing Co., Ltd.

Post Office.

Repairing wire apparatus.—Wynn, Timmins & Co., Ltd.
Telegraph apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.: Western Electric Co., Ltd.
Iron Brackets.—Bullers, Ltd.
Submarine cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraph and telephone cable.—B. I. & Helsby Cables, Ltd.; W. Geipel and Co.; General Electric Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; C. Macintosh & Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Pirelli-General Cable Works, Ltd. Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co.
Cases for telegraph sets.—Sabey & Son.
Cords for telephones.—Siemens Bros. & Co , Ltd.; Western Electric Co., Limited.
Insulators,—J. Bourne & Son; Bullers, Ltd.; Doulton & Co.; J. Macintyre and Co., Ltd.; Taylor, Tunnicliffe & Co.
Earth plates.—Walls, Ltd.
Solder.—E. Austin & Sons.
Cable suspenders.—P. Huntington & Co.
Flame-proof wire.—C. Macintosh & Co., Ltd.
Galvanized iron wire.—Shropshire Iron Co., Ltd.

Hull.—Electricity Committee :—

Stirling Boiler Co.—Boiler.
Ings Foundry, Wakefield.—Stoker.

Ipswich.—Corporation Electricity Committee :—

Brush Electrical Engineering Co., Ltd.—3,000-kw. Brush-Ljungström steam turbo-alternator, condensing plant, &c., £19,150.

The Committee has power to purchase the remainder of the plant and machinery required for the carrying out of the complete scheme.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, June 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. General meeting.

Electrical Power Engineers' Association (Northern Division).—Saturday June 29th. At 6 p.m. Inaugural meeting of Glasgow and District Branch at Central Halls, 25, Bath Street, Glasgow.

Chief Technical Assistants' Association.—Thursday, July 4th. At 6.15 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussions on "Distribution Faults and their Location," and on "Voltage Regulation."

Salford Technical and Engineering Association.—Saturday, July 6th. Visit to Messrs. Crossley Motors, Ltd., Manchester.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 82 of the Electrical Review, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d., post free. Any reader or advertiser at Home or Abroad, who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to the Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Keighley Association of Engineers.—At the annual meeting last week, the membership was reported to be 242, an increase of 34. Mr. H. Widdop was elected president; Mr. Robert Hudson, secretary; Messrs. Alfred Smith, A. D. Lund, J. Whitehead, and Walter Smith to the Council; Prof. G. F. Charnock (head of the engineering department, Bradford Technical College), honorary life member; and Mr. John R. Widdop an honorary vice-president. In the course of an address, Mr. Walter Slingsby urged the need for greater development of physical and chemical laboratories in engineering works.

Electrical Power Engineers' Association: Northern Division.—A special general meeting of the above Division was held at Manchester on Tuesday, June 18th, the President (Mr. A. L. Lunn, A.M.I.E.E.) in the chair. The report of the Salaries Sub-Committee was presented and adopted. Mr. W. A. Jones, A.M.I.E.E. (hon. sec. of the London Division), was present, and gave an address on the rapid growth of, and the work being done by, the various divisions. He reported that the E.P.E.A. had been invited by the Ministry of Labour to send representatives to a meeting, held at Manchester on June 19th, to consider the formation of a council in connection with the Whitley Report.

The chairman reported being present at the mass meeting called by the I.E.E. at Leeds the previous week, to further the promotion of a new Association for the technical staffs of electricity supply undertakings, which meeting resulted in a victory for the E.P.E.A. The Assistant Hon. Sec. (Mr. A. O. Holt) reported that arrangements had been made to hold an inaugural meeting at Central Halls, 25, Bath Street, Glasgow, on Saturday, June 29th, with the object of establishing a branch of the E.P.E.A. for Glasgow and district. A hearty invitation is extended to all interested engineers to attend this meeting. The Hon. Sec. (Mr. J. W. Thomas) reported the formation of a branch of the E.P.E.A. at Liverpool.

Industrial Reconstruction Council.—The address of this organisation in future will be 2 and 4, Tudor Street, E.C. 4, larger office accommodation having become necessary. The work has been re-organised and divided into sections, superintended by Sub-Committees. Mr. Ernest J. P. Benn remains chairman and administrative chief, Sir Alexander Roger is in charge of the membership section, Dr. William Garnett and Mr. Emil Davies control meetings, and Sir Herbert Nield, K.C., M.P., is Parliamentary representative. The Council is also extending the work of propaganda through other organisations, and is now prepared to send speakers to any societies to lecture or initiate discussions upon the various aspects of the Whitley Report. Applications should be made to the Secretary, who would also be glad to supply literature for distribution.

Prize for Paper on the Co-ordination of Research.—The Council of the Institution of Electrical Engineers is prepared to receive papers on the subject of "The Co-ordination of Research in Works and Laboratories," with a view to the paper being read and discussed at one of the ordinary meetings of the Institution in London, and also before one or more of the Local Sections. Papers should not exceed 15,000 to 20,000 words in length, and the Council is prepared to award a special premium of £25 to the author of the paper which, in its judgment, best fulfils the objects of the discussion, provided such paper reaches the standard aimed at by the Council.

Papers should be sent to the Secretary of the Institution not later than November 4th, 1918. It is the intention of the Council to publish the selected paper (which will become the property of the Institution) in the *Journal*, together with the discussion. Competitors intending to submit papers are invited to communicate with the Secretary.

Volunteer Notes.—London Army Troops Companies, Volunteer Engineers.—Headquarters: Balderton Street, Grosvenor Square, W. 1.

Corps Orders No. 26 by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Captain of the Week.—Capt. W. Darley Bentley.

Next for Duty.—Capt. E. G. Fleming.

Monday, July 1st, to Friday, July 5th.—Drills as usual.

Sunday, July 7th.—Commandant's Parade at Waterloo Station, 8.45 a.m. Work: Revetments at Heywood. Dress: Service dress, drill order, with haversacks and water bottles. Mid-day and tea rations to be carried.

C. Higgins, ***Capt.*** R.E., ***Adjutant.***

Self-Government for After-War Industry.—In a letter to the *Times*, Mr. A. H. Paterson, Secretary of the National Alliance of Employers and Employed, says :—"The failure of the Admiralty to recognise the Trade Unions in connection with the scheme they are endeavouring to carry out for the creation of Whitley Committees in the dockyards, and the delay on the part of the Postmaster-General in applying the Whitley scheme to the great organisations under his control, are two very disquieting signs to those who realise the vital necessity of a genuine reconstructive programme. It is the strong conviction of the many leading employers and Trade Unionists who have found common ground in the National Alliance of Employers and Employed that after-war industry must have self-government, and that the basis of that self-government must, and can, be arrived at by the representatives of employers and employed working together with an equality of representation, and free from outside interference. There are three parties concerned—Capital, Labour, and the community. The *rôle* of the State must simply be that of a policeman guarding the interests of the community. The Whitley Report was welcomed by this Alliance as a step (though only a step) in the right direction, but we have consistently urged the inadequacy of those proposals, in that they are neither wide enough in their scope, nor do they sufficiently realise that industrial reconstruction must be a matter for industry itself, and not for State Departments. This Alliance, by the work of its Central and Local Joint Committees (on all of which employers and employed are equally represented), is proving that it is possible to get these two parties to co-operate in working out plans for the industrial future. Through that co-operating work they are reaching a mutual understanding and a realisation of the fact that their interests are identical, and not antagonistic, and they are agreed that along these lines the industrial future can be secured. But they are equally agreed that the task of reconstruction is one to be carried out by the industrial forces themselves. The attitude of the Admiralty and the Postmaster-General in regard to the Whitley Report justifies the position which the National Alliance of Employers and Employed has taken up and these incidents will have had their value if the lessons they teach are heeded."

Notes from Spain.—Our Spanish correspondent writes :—

The Duero Waterfalls Co.—Representatives of the Bank of Bilbao and of the Duero Waterfalls Co. visited King Alfonso on June 11th, with the view of interesting his Majesty in the formation of the above company with a capital of 150,000,000 pesetas (£6,000,000 at pre-war rates).

The project has as base the utilisation of the big Duero waterfalls, which will permit the use of energy to the extent of 150,000 H.P. A scheme of this magnitude, working at a daily load factor of 40 per cent., would prove a saving to Spain of approximately half the amount of coal now imported. It is proposed to establish a network of overhead transmission lines covering the central provinces of the Peninsula.

Cantabrian Waterfalls Syndicate.—A company has been formed in Bilbao to exploit waterfalls on the Rivers Pao de Trave and Ponton, in the province of Leon.

Water-Power Committee.—The Board of Trade has appointed the following Committee to report upon the water-power resources of the United Kingdom and the extent to which they can be made available for industrial purposes:—Sir John F. C. Snell (chairman), Mr. G. S. Albright, Sir Dugald Clerk, Dr. J. F. Crowley, Mr. H. F. Carlill (Board of Trade), Mr. Philip Dawson, Prof. Gibson, Mr. Vernon Hartshorn, Dr. H. R. Mill, Mr. A. Newlands, Mr. G. C. Vyle (Associated Chambers of Commerce), Mr. A. J. Walter, K.C., Mr. Ralph Walter (Ministry of Reconstruction), and Mr. D. J. Williams. Mr. R. T. G. French is secretary, and all communications should be addressed to 10, Princes Street, Westminster, S.W. 1.

Was the Liquidator Liable?—In the City of London Court, on June 25th, before his Honour Judge Atherley-Jones, K.C., a claim was made by H. D. Crewe & Co., trading as Crewe, Allen and Co., 23, Chapel Street, Cripplegate, against Mrs. Stanley Kuhn, trading as D. A. Bessent & Co., 74, Watling Street, for £9 8s. for wiring and fitting a motor at Red Lion Court. Defendant said she was not liable, and that the debt was due from Mr. H. W. Sanders, the liquidator of E. Sandler & Co., Ltd., who had sent plaintiffs a dividend of £2 7s., and who was brought in as a third party. Plaintiffs said they returned the money, as they knew nothing of the liquidation. Judgment was given for the plaintiffs against the defendant, the third party being dismissed from the litigation.

Electric Power Supply.—A deputation of the Trade Union Parliamentary Committee recently waited on Sir Albert Stanley, President of the Board of Trade, to ask his opinion regarding the proposals made by the Committee on Electric Power Supply. In his reply, Sir Albert said the Government looked upon the question as one of the many important problems of reconstruction. A Bill for its consideration was to be introduced as soon as possible in the House of Commons. He had not a vestige of doubt that there was an opportunity in the future for everybody to secure for himself a supply of electricity at a very cheap rate.—*Yorkshire Post.*

A Question of Competition.—The following letter was received after our "Correspondence" columns were closed:—

"With respect to the two letters appearing in your issues of May 31st and June 14th under this heading, I am instructed by my Council to forward you a copy of the resolution arrived at by my Executive Committee on May 30th:—

"'The secretary brought forward letter from Messrs. Watson, Marsh & Co. complaining of the action of ——— Electric Supply, and asking for assistance: the secretary was instructed to say that if the firm would make an appointment to meet the solicitors, bringing with them any evidence that they had, either verbal or in writing, the solicitors would go into the matter, and, if thought advisable, the Association would be prepared to take action.'

"As the firm in question have not yet accepted this offer, the Association cannot proceed.

"Leonard G. Tate,
"*Secretary, Electrical Contractors' Association (Inc.).*
"London, E.C., *June 26th*, 1918."

Oil from Coal.—In the House of Commons, on Monday last, it was stated that the Ministry of Munitions was taking every possible step to increase the production of oil from coal and shale deposits in the country, and of creosote. The work was hampered by the shortage of labour, but very considerable progress had been made.

New Fuel and Light Order.—Copies of the new Household Fuel and Lighting Order have been submitted to all Fuel Overseers and members of Fuel and Lighting Committees to enable them to organise for the work they will be called upon to carry out. There has been a modification of the table of allowances, which in the London area will be as follows:—

Two-roomed flat or apartment, three tons a year; three rooms, 3½ tons.

Dwelling house or flat exceeding three rooms, four tons for four rooms, and so on, at the rate of one ton per year per room.

Following are the factors for conversion of fuel into coal, gas, or electricity:—Anthracite to count as fuel at the same rate as ordinary coal; three tons of coke to count as two tons of fuel; briquettes not sold by weight and not exceeding 2½ lb. in weight to count as 1,000 to the ton; 15,000 cb. ft. of gas to count as a ton of fuel; 800 units of electricity to count as one ton of fuel.

The allowance of fuel to be taken as coal shall not be less than 2½ tons, except with the previous assent of the Local Fuel Overseer.

The scale of lighting allowance for dwelling houses is liberal:—

One, two, or three rooms: 7,500 cb. ft. of gas or 100 units of electricity per year.

Four, five, or six rooms: 11,250 cb. ft. of gas or 150 units of electricity.

Seven, eight, or nine rooms: 15,000 cb. ft. of gas or 200 units of electricity.

Ten, eleven, or twelve rooms: 18,750 cb. ft. of gas or 250 units of electricity.

Where gas and electricity are used, the consumer may continue to use both on one ration only, the conversion factor being 750 cb. ft. of gas equivalent to 10 units of electricity; but the foregoing light allowance may not be converted into fuel. Quarterly proportions are to be taken in the ratios of one-third of the total for either winter quarter, and one-sixth of the total for either summer quarter: which is to say, that the maximum quarter or the summer half-year must not exceed one-third of the year's supply.

Engineering Wages.—The skilled workers in the engineering trades have asked the Employers' Federation for an increase in wages of 100 per cent. over pre-war rates, while the unskilled and partly skilled workers in the engineering and shipbuilding trades also have made a demand for an increase, which is placed at 10s. per week above current rates. Both claims came before the Committee on Production on Wednesday, and the decision will be made known later.—*Daily Telegraph.*

Phototelegraphy.—Prof. Arthur Korn, a German electrical expert, is said to have invented a system permitting of the sending of photographs by long submarine cables. Korn was the inventor of a system for transmitting photographs by land wires.—*Wireless Press.*

An Electric Organ in Westminster Abbey.—According to the *Sunday Times*, a "Celestial" organ has been presented to the Abbey by Mr. Clarke. It is placed in the triforium of the south transept, above the tomb of Handel, entirely hidden from observation by the congregation seated below. Though in all respects a separate organ, complete in itself, it forms a part of the grand instrument in the choir. By means of an electric cable 200 ft. in length the new organ is connected with the old, and controlled from the same console; it may be played by itself, or may be used in conjunction with the main organ.

Institution and Lecture Notes.—Institute of Metals.—The annual autumn meeting of the Institute will be held in London on September 11th, when several important papers will be presented for discussion. A ballot for the election of members will be held on July 17th, as a result of which the membership is expected to be brought well beyond the 1,000 mark, and that within the first decade of the Institute's existence. In connection with the ballot, there has just been prepared for circulation to possible members an attractive new membership booklet, containing a detailed statement of the Institute's varied activities; copies can be obtained from Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. 1.

Tramways and Light Railways Association.—The tenth annual congress takes place at Caxton Hall, S.W. 1, at 3 p.m., on Friday, July 12th.

Appointments Vacant.—Mains jointer (9d. per hour + 20s. + 12½ per cent.), for the Farnworth U.D.C. Electricity Works; shift engineer (63s.), for the Tunbridge Wells Corporation Electricity Department; electrical staff, for the Ordnance Depôts, Aerodromes, and Military Camps in the Southern Command; jointer wireman for the Curragh Camp Electric Light Station; two switchboard attendants, for the Northampton Corporation Tramways; electrical engineer, for the Department of Electrical Engineering, Admiralty. See "Official Notices" to-day.

Water-power in War-time.—According to *Le Génie Civil*, Commandant H. Cahen, at the Civil Engineers' Congress held recently in Paris, spoke on the considerable *rôle* played by water-power in war-time, and said some important results had been obtained. Before the war 750,000 H.P. with a realisable value of 800 million francs was made use of, this being about one-tenth of the total power available, which is estimated to be at least 8 million horse-power. In Switzerland, official statistics published in 1914 prove that the water-power used there is 16 per cent. of the available total. In August, 1915, a start was made to intensify the resources of water-power, and manufacturers made, at the request of the Under Secretary for War Materials, great efforts in spite of many difficulties. Since the end of 1915, the falls which had been or were in the course of development, represented at least 565,000 H.P., and those actually in harness represented 850,000 H.P. Further, at the end of 1917, 120,000 H.P. was placed at the disposal of the National Defence; 330,000 H.P. was harnessed in 1918, and the remainder will be completed during 1919 and 1920. This great effort was responded to by nearly every part of France, as the following table indicates:—

Alps	428,000	H.P.
Central Plateau	200.000	..
Pyrenees	185,000	„
Jura and Vosges	35,000	„
West	2,000	„
Total	850,000	„

By the end of 1921, France will have at least 1,600,000 H.P. under control, representing a value of 1,500 million francs. Interesting and fruitful efforts were made by those concerned in the use of energy derived from newly developed water-powers, some for electrochemical, some for electrometallurgical purposes, and others by utilising directly the static pressure of the water of the higher falls to operate presses in the manufacture of rough shell forgings. These results could not have been obtained without the unity which reigned between manufacturers and the interested authorities. Numerous special authorisations to commence work were given, without waiting for formalities or the results of formal inquiries. Water-power has, therefore, rendered great service to the National Defence, and it can be said that all developments of water-powers bring about a corresponding decrease in coal consumption. During the few years preceding the war, water-power was developed to the extent of 750,000 H.P.; at the same time coal consumption increased by 24 million tons, and this in spite of a drop of 20 million tons in the national output of coal. On the other hand, it can be said that if this 750,000 H.P. had not been developed, this deficit would have been considerably greater. The development of water powers creates other needs which necessitate simultaneously a greater output of coal.

The Electrolytic Recovery of Tin.—For detinning tin cans the affinity of chlorine gas for tin can be made use of, as follows :—The scrap tin waste is charged into large iron vertical cylinders, after being lightly bundled into billets. These billets rest on gratings arranged at suitable intervals in the iron cylinder. Dry chlorine gas is then admitted under a slight pressure into the cylinder, and combines with the tin on the scrap to form tin tetrachloride (Sn_2Cl_4) as a fuming liquid, which is collected in a tank arranged at the base of the cylinder. It is of the utmost importance that the chlorine should be perfectly dry, otherwise it would attack the iron cylinder and other apparatus. To effect this in practice it is usual to compress the chlorine gas over concentrated sulphuric acid. It is also necessary that every care should be taken to prevent the escape of chlorine gas, owing to its poisonous properties. The tin tetrachloride produced by this method can, if necessary, be electrolysed to form tin and stannous chloride.

By another process the tin from the scrap is dissolved in an aqueous solution of tin tetrachloride. The resultant stannous chloride, on being electrolysed, decomposes into tin and chlorine, and the latter re-combines with stannous chloride to form tin tetrachloride, with which further quantities of scrap are treated.

The recovery of tin from stannate solution is, perhaps, the most economical process to adopt at the present time, especially owing to the simplicity of the plant required for this purpose, and also in view of the fact that the materials and solutions required can be readily obtained.

In this process the scrap tin, after cleansing, to remove grease, &c., is charged into suitable containers and immersed in a hot caustic soda solution. Cathodes consisting of iron or copper plates are arranged in the vicinity of the containers, on which the tin is deposited in spongy form ; it is removed from time to time and reduced to metallic tin in a special furnace. A plant of this type, requiring about 20 KW. working continuously, is found capable of dealing with about 15 tons of scrap per week, and recovering about 3 cwt. of tin of 98 per cent. purity.

When dealing with the tin can, many other considerations have to be taken into account in connection with the salving of the tinned sheet steel of which it is composed. Such waste contains solder, paper, varnish, fats, rubber, and other organic matter, all of which have to be removed before treatment. In dealing with the last material, it is necessary first to perforate the tins by passing them through suitable rolls. They are then washed in a caustic alkali solution to remove organic matter, and transferred to an electrolytic detinning bath by means of drums which are revolved mechanically in a solution of sodium stannate. The tin is deposited on cathodes arranged radially on either side of the immersed section, the sizes of vats and drums being designed according to the tonnage for treatment. The solder is extracted in a desoldering furnace, provided with means of obtaining a neutral or non-oxidising atmosphere in contact with the scrap, in order to avoid excessive oxidisation, and, when a clean steel is obtained, hydraulic or mechanical presses are used for pressing the steel into blocks.

For the recovery of tin deposited on the cathodes, it is suggested that the powder be formed into briquettes, consisting of tin, charcoal, salt, and a small quantity of resin. These briquettes are reduced in a lignating furnace, the residual slag being ground up and re-dissolved in water to recover any alkali remaining.

The organic matter recovered from washing tanks is run into settling backs, after which it is rendered down and refined. Any solid matter is skimmed off the surface of the tank, and residual sediment can be removed from a false bottom.—*Salvage.*

Electric Precipitation.—According to the *Journal of Electricity*, an electric precipitation process has enabled the U.S.A. cement workers to obtain potash from the residue dust. In one case a year's trial under practical operation has resulted in the rather astonishing result of having a greater income from potash than from cement. Operating costs show conclusively that the process will be profitable at pre-war prices, and that a supply of potash for fertiliser as well as ammunition is now assured.

Sound-Range Telephones.—Major-General J. Franklin Bell, U.S.A., who has lately returned from an inspection trip on the front in France, has imparted to the Senate Military Committee the results of his observations, among which the *Electrical World* notes the success of the new sound-range telephone system for ascertaining the positions of enemy guns. The Germans captured one of the telephones, and are now also using the system. General Bell says :—

" All armies now employ scientific methods of locating guns, one of which is known as the sound-ranging method. Briefly, they have observers scattered along a curved line which has been accurately measured, and all of these observers, of whom there are usually six, utilise electrical sound-ranging apparatus by which they report instantaneously the moment they hear the sound of a gun explosion. At a central point another electrical apparatus records these sounds from the six different stations, and by a scientific method they combine the knowledge gained from these six points, and succeed in locating with a remarkable degree of accuracy the position of the gun that made the explosion when it was fired.

" Each side has a type of telephone which is able to hear distinctly over very considerable distances conversations not intended for the listener, and for a long time the Allies employed this system of gaining information without the knowledge of the enemy ; but the Germans captured one of these instruments and discovered that their conversations in the trenches had been listened to for quite a while, and that the Allies had thus gained some information in a way that had long puzzled the Germans."

Patents and Alien Enemies.—Application has been made by the James Keith & Blackman Co., Ltd., to the Board of Trade to avoid or suspend Patents Nos. 22,433/10, 27,696/11, and 1,382/13, granted to Theisen, for apparatus for purifying and cooling gases.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At the Keighley T.C. meeting last week, the Tramways and Electricity Committee sought power to appoint an assistant electrical engineer and tramway manager at a commencing salary of £200 per annum. An amendment was moved that the two positions should not be bracketed, and that the position be that of assistant electrical engineer only. The amendment was defeated by a large majority, but an amendment leaving the question of salary with the Committee was carried.

Mr. F. Windows has been appointed mains superintendent by the Hull Electricity Committee.

The King's Lynn T.C. has decided to grant the electrical engineer a further bonus of £40 per annum for the duration of the war. The Chief Industrial Commissioner had intimated to the Corporation that it was not compelled to pay him the 12½ per cent. bonus.

Mr. A. R. Tudman, who has been the engineer in charge of the Colwyn Bay Council's electricity undertaking since it was opened nearly 20 years ago has tendered his resignation on being appointed to an important post under a Manchester firm.

Bexhill E.L. Committee has decided to increase the salary of the engineer (Mr. C. A. Frost) from £300 to £350.

The Bolton E.C. has voted increased salaries to Mr. B. S. Hornby (chief assistant engineer) from £280 to £310 per annum, and Mr. H. E. Annett (resident engineer) from £280 to £310 per annum.

General.—We have received the following letter :—" May I make a correction in regard to your notice, on the 7th inst., of the conviction of Mr. Harrison Barrow, for an offence under the D.O.R.A.? The alderman presiding at the Guildhall agreed that the statement of authorship on the leaflet was sufficient. It was, therefore, *only* for carrying out the refusal of the Society of Friends to submit to the Censor the publications which it thinks it right to issue that Mr. Barrow was convicted.—Joseph Sturge. Birmingham, June 18th, 1918."

On Saturday last, at St. Matthew's Church, Surbiton, Captain A. C. Sparks, M.C., eldest son of Mr. C. P. Sparks, Past President of the I.E.E., was married to Miss Sybil Fuller.

The desire to attack all and sundry once more came into evidence in the House of Commons, on Wednesday, when Mr. Pemberton Billing asked whether Sir Albert Stanley, the President of the Board of Trade, was a German of the name of Knattries. It was shown, in reply, that Sir Albert's father and mother were born in Derbyshire of English parents. They left this country for America when he was a child, and later the name was changed from Knattries—a good old English name—because it was difficult to remember and pronounce. Sir Albert stated that the family had resided in Derbyshire for many generations.

Roll of Honour.—According to the *Times*, Second-Lieut. E. B. Ritson, M.G.C., who has fallen in France, entered Faraday House in 1902. In May, 1905, he received an appointment with the Mexican Light and Power Co., and after two years as engineer at Necaxa, he returned to England and joined Callender's Cable and Construction Co., Ltd., where he was employed when the war broke out.

Air Mechanic C. Foster, R.F.C., who has died in hospital at Lincoln from appendicitis, was an apprentice with Mr. James Batty, electrician, Burnley.

Private L. Holland, L.N. Lancs. Regiment, who has been killed in action, was an electrician with Messrs. J. Lomax Kendall and Co., Ltd., Manchester.

Private E. Thackray, Lincolns, who is a prisoner of war, was employed by Mr. C. Franklin Tubb, electrical engineer, Leeds.

Gunner Fred Wheelhouse, R.F.A., who has been awarded the Military Medal for carrying dispatches under heavy fire, was on the staff of the Leeds Corporation Tramways Department.

Private P. Toole, K.O.R.L. Regiment, who has died from wounds, was employed at Blackburn Electricity Works.

Private T. Fox, Lewis Gun Section, Manchester Regiment, killed in action, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private C. R. Reed, Lancashire Fusiliers, who has died of wounds, was an electrical engineer on the staff of a firm at Bath.

Gunner W. H. Garbutt, R.F.A., who was before the war a fitter at the New Cross tramway depôt, has been awarded the Military Medal.

Quartermaster-Sergeant T. H. Clarke, Border Regt., who was an electrical engineer at the Keswick E.L. Works, has been killed in action.

Gunner C. Peacock, R.G.A., who has fallen in action, was with Messrs. Elliott Bros., Lewisham.

Corporal J. James, Shropshire Light Infantry, formerly an electrical engineer at Blaengwynfi, South Wales, has been killed in action.

Lance-Corporal G. Cox, employed at the Carron Works, Falkirk, has been awarded the Military Medal.

Lance-Corporal A. C. Hinder, an electrical machinist at the South Wales Steel Works, is a prisoner of war.

Captain and Temporary Major N. H. Hamilton, R.A.F., who is an electrical and wireless engineer, has been awarded the D.S.O.

Quartermaster-Sergeant Rowland de Ville, of the R.F.A. (Stafford Battery), who has been mentioned in dispatches, was in the drawing offices of Messrs. Siemens Bros.' works at Stafford.

Captain J. Holmes, who was in the employment of the Central Electric Supply Co. at the Grove Road power station before the war, has been awarded the Military Cross for gallantry during the German offensive in March.

Obituary.—The death has occurred of Mr. F. G. Micklewright, electrical engineer, Maidstone. Deceased was 40 years of age, and died from injuries sustained through a motor lorry, in which he was sitting, dashing into a shop front, Mr. Micklewright being crushed between the vehicle and the building.

Mr. John Bottomley, who passed away in New York on June 16th, was vice-president, secretary, and treasurer of the Marconi Wireless Telegraph Co. of America, and brother of Dr. J. T. Bottomley, F.R.S., of Glasgow.

Will.—The late Mr. Robert S. Blackwell, chairman of R. W. Blackwell & Co., Ltd., and of Johnson & Phillips, Ltd., left £91,288 gross and £90,890 net personalty.

NEW COMPANIES REGISTERED.

Thomas Smith & Sons (Rodley), Ltd. (150,707).—Private company. Registered June 12th. Capital, £150,000 in £1 shares (50,000 pref.). To take over the business of mechanical and electrical engineers carried on at the Steam & Electric Crane Works, Rodley, near Leeds, as Thomas Smith & Sons, also to carry on the business of tool makers, iron and steel converters, woodworkers, builders, painters, &c. The subscribers (each with one share) are:—F. H. Smith, Springville, Shaw's Lane, Leeds, engineer; W. T. Smith, Mayholme, West Park, Leeds, engineer; G. E. Smith, Wymoor, Ancester Road, Leeds, engineer. The first directors are: F. H. Smith, W. T. Smith, and G. E. Smith. Qualification, £500 shares. Registered office: The Steam & Electric Crane Works, Rodley, near Leeds.

Metallic Electrodes, Ltd. (150,675).—Private company. Registered June 7th. Capital £10,000 in 9,500 ord. shares of £1 each and 20,000 def. shares of 6d. each. To carry on the business of reconstructing by agglomerating, restoring, and otherwise utilising metal trimmings, sawings, turnings, and scale of metal and scrap, and any other waste of metal, china, glass, pottery, coal, or other substance, &c. The subscribers (each with one ord. share) are:—J. G. Mason, 26, Dalebury Road, S.W., secretary; A. P. Kirkaldy, 3, Chislehurst Road, Richmond, Surrey, stockbroker. Permanent directors: T. Rouse and W. S. Leefe. W. S. Leefe's address is 23, Coleman Street, E.C.

Taranto Tramways & Electric Supply Co., Ltd. (150,704).—Registered June 11th. Capital, £100,000 in £1 shares. To acquire a concession granted by the Municipality of Taranto, Italy, to construct, equip, maintain, and work electric tramways in and around the said city, &c. Agreement with Rhys-Jones, McTaggart & Co. The subscribers (each with one share) are:—Sir Edward Zohrab, Bart., New Walk, Leicester, civil engineer; E. J. Summers, 132, Ferme Park Road, Crouch End, N., secretary; G. T. Weekes, 20, Priory Avenue, Caversham, Oxon., solicitor; H. Pettitt, 18, Austin Friars, E.C., solicitor; A. C. Dowsing, 4, Lardon Road, Acton, W., secretary; W. A. Pittman, 18, Austin Friars, E.C., solicitor's clerk; P. B. Potter, 29, Gubyon Avenue, Herne Hill, S.E., secretary. The first directors are to be appointed by the subscribers. Qualification, £100. Solicitors: Slaughter & Nay, 18, Austin Friars, E.C.

Hightensite, Ltd. (150,736).—Private company. Registered June 15th. Capital, £50,000 in £1 shares. To acquire the business of manufacturing a material called "Hightensite," being a substitute for the German material "Stabilit," a compound of rubber used for magneto and rotary engine distributors, capable of being used for all purposes requiring a high electrical insulation, which manufacture is now carried on as a branch business by the Park Royal Engineering Works, Ltd., at Streatham, S.W. The subscribers (each with one share) are:—A. G. Morrish, 34-6, Gresham Street, E.C., chartered accountant; A. Spurrier, Sussex Grove, Putney Park Avenue, S.W. 15. The first directors are: Sir Lindsey B. Peters, K.B.E., A. Spurrier, A. G. Morrish, V. E. Joyce, and H. G. Morrish. Registered office: 34-6, Gresham Street, E.C.

Trafford Power & Light Supply (1902), Ltd.—Particulars of £65,000 debentures created May 13th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first mortgage debenture stock for £35,000. No trustees. (Of the £40,000 second mortgage debentures previously registered, a debenture for £25,000 has been postponed and become a third mortgage debenture, and the series of second mortgage debentures has been increased by the above issue, making a total of £65,000 second mortgage debentures.)

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Record Electrical Co., Ltd.—Issue on May 25th, 1918, of £500 debentures, part of a series of which particulars have already been filed.

James Keith & Blackman Co., Ltd.—Memorandum of satisfaction in full on November 11th, 1917, of first debentures dated 1902 and 1910, securing £2,400, (*b*) on May 15th, 1918, of first debentures dated 1907, 1901-7, securing £1,650, and (*c*) on May 15th, 1918, of second debentures dated 1913, securing £250, has been filed.

F. E. Baker, Ltd.—Particulars of £8,600 debentures created June 6th, 1918, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Gloucestershire Electric Power Syndicate, Ltd.—Memorandum of satisfaction in full on May 31st, 1918, of debentures dated February [illegible], [illegible], securing £650, has been filed.

Larne Electric Light Works, Ltd.—Memorandum of satisfaction in full on May 29th, 1918, of debentures dated October 13th, 1910, securing £2,200, has been filed.

Memorandum of satisfaction in full on May 29th, 1918, of debentures dated 1896-7, securing £500, has been filed.

Bromley (Kent) Electric Light & Power Co., Ltd. (54,127).—Capital, £100,000 in £5 shares. Return dated April 22nd, 1918. 15,000 shares taken up. £75,000 paid. Mortgages and charges: £64,063.

British Insulated & Helsby Cables, Ltd. (52,285).—Capital £1,000,000 in 500,000 pref. and 500,000 ord. shares of £1 each. Return dated April 8th, 1918. All shares taken up. £572,675 paid on 372,350 pref. and 200,325 ord.; £427,325 considered as paid on the remainder. Mortgages and charges: £700,000.

Alderley & Wilmslow Electric Supply, Ltd. (47,663).—Capital, £30,000 in 20,000 ord. and 10,000 pref. shares of £1 each. Return dated May 15th, 1918. 15,009 shares taken up. £15,009 paid. Mortgages and charges £15,009 (stated on previous returns as £15,000).

CITY NOTES.

Aluminium Corpn., Ltd.

Mr. K. M. Clark, presiding at the annual meeting last week, said that in the interests of general efficiency the general office had been removed from London to the works in North Wales, where they continued to consolidate the business. The carbon works were removed from Wallsend to North Wales some years ago, with satisfactory results, and they now had a rolling mill in work upon the same site as the reduction works. They had purchased the entire share capital of the Aluminium Foil Co., Ltd., and its business was being conducted as a subsidiary. He hoped that in due course they would be able to concentrate all their various processes in North Wales. They hoped in the near future to submit a scheme for funding the three years' preference dividend in arrear. The rainfall last year upon their watershed was 13 in. below that of 1916, and in consequence the output fell short of the previous year's figures, but their efficiency per inch of rain was greater than it had ever been, this result being obtained by the new works they had had in progress. The general progress of the company had continued upon the upward grade. Work had proceeded in the past year upon the construction of the new dam, and upon other work necessary to increase the company's water power, and a considerable amount of property had been acquired to enable the company to obtain the greatest benefits from the water power available. They had been able to keep their necessary stocks of raw material in a satisfactory condition. The rolling mill had proved a great acquisition, and a large and satisfactory business had been done in aluminium sheets. With regard to the future, he was, by the events of the last three years, strengthened in his sanguine view as to the company's prospects. The metal produced had been of great service to the country during the war. There could be no question that the familiarity obtained by so many workers in handling aluminium during the war operations, and the extreme usefulness it had been proved to possess, would remove a great deal of the prejudice that was previously experienced against its introduction in many commercial fields. Personally, he felt that the electrical industry, the chemical and brewing trades, and also vehicle manufacturers would make much freer use of aluminium on the return of peace than they did prior to the war. Of course, the world's output had been very largely developed. It was, in fact, estimated at about five times the quantity produced 10 years ago, but there seemed no reason to doubt that the consumption, both present and future, was quite able to take care of even a larger output than had yet been produced. The British Government had recognised that aluminium was a key industry of great national importance, and they had shown by their actions that they considered it essential for the future welfare of this country that the home production should be substantially increased. The costs of production had shown large increases. The seaborne freight of their raw material had been very heavy, and, in fact, the keeping up of necessary supplies would have been impossible had they not received very hearty support from both the British and French Governments. With a view to increasing the productive capacity of the works, they had arranged to increase the capacity of the sheet rolling mill. A power press had been installed. The purchase of shares in the Aluminium Foil Co., together with other developments in hand, would enable them in the near future to market the whole of their output in a more finished form than had hitherto been possible. The return of peace would, of course, not mean the immediate return of normal conditions. A period during which inflated costs and shortage of materials would prevail must be experienced.

Kalgoorlie Electric Power and Lighting Corpn., Ltd.

At the annual meeting, Mr. E. Pope, the chairman, said that the profit was £2,906 less than for 1916. The decrease was a measure of the depreciation which had taken place in the prospects of Kalgoorlie, due largely, but not entirely, to war conditions. There was a decrease beyond their anticipation in the profit made during the last four months of the year, and they were obliged to notify that no dividend could be paid in

April this year. He was unable to say when the financial position would permit of another payment, but immediately there was sufficient money available a distribution on the preference shares would be made. Present conditions in Kalgoorlie tended to decrease receipts and to increase costs; it seemed unlikely that there would be any beneficial change during the war. Until the end they must do their best to carry on at a profit, with dividends if possible, but they might have to strive hard to pay their debts and heavy taxes, and carry on till better times again prevailed. The cabled results of gross profits for the five months of this year showed a decrease of £1,792. Their future was intimately bound up with that of the Kalgoorlie goldfield.

Oriental Telephone and Electric Co., Ltd. For the year ended at December, 1917, the gross earnings, including dividends and interest from subsidiary companies, &c., were £110,420, plus several items bringing up the total to £133,360. The working expenses, maintenance, &c., were £49,607, and after paying debenture interest and redemption charges, paying the preference dividend, also a total dividend of 10 per cent. on the ordinary shares and a bonus of 1s. per share free of tax, £25,000 is put to general reserve, £2,000 to staff pension fund, and £17,196 is carried forward.

The company's exchanges show additions in the number of stations connected up during the year, with a corresponding increase in revenue. Additions are, however, small when compared with developments in previous years, owing to the prohibition by the Government of India of new work, and to the difficulty in obtaining supplies of material. Applications for connections have been received from a large number of new subscribers, and although for the time being development is almost at a standstill, the future prospects of the company appear to be satisfactory. It is anticipated that the reconstruction of the Singapore building will be completed by the end of the current year, and the new exchange equipment is promised for delivery in Singapore at about the same time. Considerable expenditure on buildings, exchange equipment, cable installations, renewal of line construction, instruments, &c., will be necessary in Madras, Rangoon, Singapore, and Mauritius when normal conditions are restored, as well as additions to capital account for new installations.

No addition has been made to the reserve for depreciation, the directors being advised by the company's consulting engineers that the sum of £40,000 already standing to the credit of this account is sufficient to meet depreciation up to December 31st, 1917.

The Bombay Telephone Co. and the Bengal Telephone Co. show increased revenues for the past year. The Bengal Telephone Co. has paid the same dividend as for 1916, viz., 7 per cent. The Bombay Telephone Co. has paid a dividend of 16 per cent., as against 12 per cent. for the year 1916. The net revenue in the case of the Telephone Co. of Egypt and the China and Japan Telephone & Electric Co. is somewhat less than for 1916. Both companies are paying their previous rates of dividend, viz., 10 per cent.

As already notified, the Government of Egypt purchased the undertaking of the Telephone Co. of Egypt for £755,000, as from January 1st, 1918. Proposals for the application of these moneys will be made in due course.

At the meeting to-day resolutions will be submitted for increasing the capital to £400,000 by the creation of 100,000 new ordinary shares of £1 each.

Marconi International Marine Communication Co., Ltd. During 1917 the business continued to show substantial expansion. The gross revenue amounted to £470,658, an increase of £200,476, derived principally from rentals of additional ships fitted. The necessary restrictions in respect of private messages at sea have continued, and prevented revenue being received from this source. The profit is £192,056, from which is deducted £50,000, a necessary allowance for obsolescence of plant, leaving net profit £142,056. In the preceding year the net profit amounted to £96,748. The improvement is about proportionate to the increase of the business.

The balance of the debenture reserve account and the balance of share premium account have been transferred to general reserve, which now stands at £258,009. The losses sustained in consequence of attacks upon the mercantile fleet during the year 1917 have been debited to profit and loss.

The total number of public telegraph stations owned and worked by the company on the high seas increased from 1,472 to 2,265. The organisation of the company, together with that of its associated companies, with a total of some 4,000 mercantile vessels fitted with Marconi telegraph stations, has continued to render inestimable service.

The directors recommend a final dividend of 10 per cent. for 1917, making 15 per cent. for the year.

The Amalgamated Wireless (Australasia), Ltd., in which this company is interested, has paid a dividend of 5 per cent. in respect of the year ending June 30th, 1917.

The increase of the capital of the company to £600,000 was duly confirmed at the extraordinary general meeting held on July 25th, 1917, and the 250,000 new shares were offered to the shareholders at a premium of 15s. per share on August 31st. The issue was over applied for, and allotments were made *pro rata* to the holdings of the applicants.

This increase of capital became necessary in consequence of the decision of His Majesty's Government to make the provision of wireless telegraph apparatus compulsory on all merchant ships of 1,600 tons gross and over, and to require two operators to be carried on all vessels fitted. At the request of the Board of Trade this company undertook to provide the necessary apparatus and trained operators.

Edgar Allen & Co., Ltd.—After paying the preference dividend, putting £20,000 to general reserve, and paying 10 per cent. and a bonus of 1s. 6d. per share (total 17½ per cent.) on the ordinary shares, free of tax, £35,340 is to be carried forward.

Victoria Falls & Transvaal Power Co.—Final dividend of 4 per cent. less tax, on the pref. shares, making 10 per cent. for 1917, and a dividend of 3 per cent., less tax, on account of 1918. Dividend of 5 per cent., less tax, on the ordinary in respect of 1917.

Eastern Telegraph Co., Ltd.—Preference dividend at the rate of 3½ per cent. per annum, less income-tax for the quarter ending June 30th, and a first quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax.

British Electric Traction Co., Ltd.—Presiding at the annual meeting, on Tuesday, Mr. Garcke said that they had made more profit than in 1916, and had applied the increased profits made by the associated companies mainly to strengthening the financial position. The greater part of the speaker's remarks, according to the report in the financial Press, dealt with the reports recently issued bearing upon the future of the electricity supply and electrical industry, which he said were, in his opinion, a condemnation of the electrical legislation of the last 36 years. He referred to the condition of the electrical industry before the war as being ludicrous, and inquired how it was that for nearly 40 years they had been unable to get views adopted which now appeared self-evident. He predicted that if the present questions were tackled comprehensively and equitably, the electrical industry after the war would prosper to a surprising extent. Mr. Garcke expressed the view that the pioneers of the electrical industry in this country had had a hard time, but they had made the path easier for those who followed them.

Brush Electrical Engineering Co., Ltd.—Addressing the annual meeting, Mr. Garcke said that the demand for Ljungström turbo-generator sets and auxiliaries had increased so rapidly that to keep pace with it they had had to arrange for a large extension of their machine-tool equipment. Their friends the British Ljungström Marine Turbine Co., who controlled the marine propulsion rights of that turbine, had made excellent progress. Important orders were now in hand, and they could congratulate themselves on having acquired a valuable asset in this turbine. They were anxious not to pay a larger dividend than they felt confident could be maintained, and therefore suggested that the present distribution of 12 per cent. should be regarded as in respect of the two years in which the dividend had been earned, and that the declaration should be at the rate of 6 per cent. per annum for each of those two years.

Calcutta Tramways Co., Ltd.—Sir H. Kimber, presiding at the annual meeting, said that the revenue account showed a fall of only £31 in the traffic receipts, due to the reduction in mileage which they were called upon to make before they could obtain Government authority for procuring supplies necessary for carrying on the system. Power expenses were about the same as in 1916. Traffic expenses showed a small increase, maintenance and repairs a decrease, and general expenses an increase. There was a loss of £3,187 on sale of investments. During the current year the traffic receipts had substantially improved, the aggregate increase to date amounting to upwards of Rs. 115,000, but there would be increased running expenses owing to the continual rise in the cost of supplies and the difficulty of obtaining them.

Imperial Tramways Co., Ltd.—The passengers carried on the Middlesbrough, Stockton & Thornaby electric tramways increased from 12,850,555 to 13,219,147, and the net profit from £14,229 to £16,540. Fares were raised by 50 per cent. as from September 1st last. The Imperial Co. holds 125,000 5 per cent. cum. pref. shares and 118,820 ordinary, all of £1 each, in the London & Suburban Traction Co., but the revenue only admitted of the payment of a dividend on the preference shares at the rate of 2½ per cent. The Imperial Co.'s net revenue account allows of a final dividend at 6 per cent. per annum on the preference capital, less income-tax, and one of 2 per cent. on the ordinary capital, less income-tax, carrying forward £143. The death is recorded of Mr. H. C. Godfray, who had been a director for 25 years.

Barcelona Traction, Light & Power Co.—Bondholders are being informed by the committee, appointed in 1915 to watch over their interests, that, owing to the delay and complications resulting from the continuance of the European war, affecting both the delivery and the cost of machinery and other supplies, it will not be possible for the company to resume full payment in cash of the interest on its bonds on December 1st next, as was contemplated when the bondholders met in June, 1915. A plan is being formulated, the basis of which will be the payment in cash of a portion of the interest commencing with the coupon due December 1st, 1918, with compensating arrangements for deferring payments of the full interest.—*Financial Times.*

Waygood-Otis, Ltd.—Mr. H. C. Walker, at the annual meeting, said that they were engaged on work much of which was of a special character, and new to them. This called for the purchase of additional new and modern machine tools, but these would be useful also for future work when they required to revert to, and to prepare to cope with, the maximum demand in their pre-war line of business as lift manufacturers.

Globe Telegraph & Trust Co., Ltd.—For the year ended May 31st, 1918, the net revenue, after deduction of expenses, amounts to £228,394, plus £55,176 brought forward. There has been transferred to reserve for contingencies £75,000, 6 per cent., less income-tax, has been paid on the preference shares, and a total of 7 per cent., free of tax, on the ordinary shares.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Tees Power Station Co., Ltd.—£260,000 fully-paid scrip and £340,000 50 per cent. paid scrip for 6 per cent. first mortgage debentures.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—First quarterly interim dividend 3s. per share, free of tax.

Montreal Light, Heat & Power Co.—Dividend 2 per cent. for quarter ending July 31st.

Montreal Light, Heat & Power Consolidated Co.—Dividend 1 per cent. for quarter ending July 31st.

W. & T. Avery, Ltd.—Final dividend 10 per cent. on ordinary shares, making 15 per cent. for the year.

Clarke, Chapman & Co., Ltd.—Interim dividend 2s. per share, less tax.

STOCKS AND SHARES.

Tuesday Evening.

The revival in the Stock Exchange markets continues to make further progress. Thanks to the excellent news from the Italian front, a fresh accession of strength developed in many departments round the House, and amongst these, industrials stood out with peculiar prominence. Elsewhere, home railway stocks advanced, and notable rises have been gained by Mexican issues of all kinds, the bonds of the utility companies shooting up several points at a time. The publication of the report from the Marconi International Marine Co. confirmed the favourable estimates which had been formed in advance of the company's increased prosperity, without, however, affecting the prices in this group to any extent.

The home railway market derives support from tardy recognition of the good returns offered to investors by the stocks. Most of the prices now carry six months' dividends, and in the strength which has accrued to the market for dividend payers, the lower-priced stocks have now participated. In the former group, the Income Bonds of the Underground Electric Co. have risen to 77. Districts further advanced to 18. The fear that the dividend on the income bonds may have to be reduced is now countered by the rumour that fares are to be put up, which also, of course, will affect the District Co. Metropolitan Consolidated also hardened a point. It may be mentioned, incidentally, that the only issue in the list of home railway ordinary stocks and shares which shows an appreciation over the pre-war making-up price of July 27th, 1914, is London Electric Ordinary, which stands now at 2¼ against 30s. four years ago. Districts just before the war made up at 21¾, and Metropolitan Consolidated at 37½, while Central London Assented Ordinary, now quoted at 62½, is still 20½ points below the quotation at that time.

From the spectacular point of view, the principal rises this week are those in Mexican utilities. Following upon the interview of President Wilson to Mexican journalists about a fortnight ago, there have been several indirect considerations which lead to the inference that affairs in Mexico may be expected to settle down rather sooner than had been thought possible. Thanks to this, Mexico Tramway bonds have gone up 6½ points, and the Seconds at 34½ are 4½ up. Mexican Light & Power Bonds have similarly recovered. Pachuca Fives at 41 are 5 points to the good, and these rises point more to the difficulty that there is of obtaining stock than to any volume of business that has occurred by reason of the changed conditions. Holders naturally are not desirous of parting with their bonds just when there seems to be a possibility of better times ahead, so that it takes comparatively little demand for quotations to advance smartly.

The recent report issued by the Mexican Railway Co. shows conclusively enough that property has suffered to a material extent owing to the revolutionary conditions that have prevailed for the past half decade, but the argument runs that once normal conditions were restored in the country, there would be no lack of money available for putting things to rights if it were shown conclusively that there were ample scope for profitable working of the utility companies.

Other foreign descriptions are generally strong. Brazilian Tractions are 2 points higher, but the Anglo-Argentine group makes no headway. There is still a little activity in Pernambuco Tramways, the price being about 8s. Victoria Falls issues continue to be depressed by evidence, afforded by dividend declarations from the leading mines, of the difficulties that surround industrial working in the Transvaal at the present time—difficulties that are hardly likely to decrease during the progress of the war, unless a substantial scheme of Government support should be formulated. The dividend of 5 per cent. goes against 5 per cent. a year ago, but the ordinary are dull at 17s. 9d., the preference being 23s. 3d. British Columbia Electrics are materially better, the deferred gaining 5 and the preferred 4 points.

In the electric supply group, Chelseas have risen ⅛ to 3⅛, and South Londons advanced to 3, but both Countys and Westminsters are ⅛ lower. The manufacturing group is still on the up-grade. One feature is the strength of British Westinghouse Preference, which have risen a further 5s. to 2⅝. General Electric Ordinary are 1 up at 23, and the Preference improved to 10⅜. Electric Constructions, on the other hand, are a little easier at 1 3/16, and Edisons are rather less active, the price going back a trifle to 41s. The latter company's 7 per cent. participating preference was last done at 22s. 1½d. Hydro-Electrics are attracting less attention than they were, the price now being 12s. Cromptons keep good at 15s., and the Preference at 19s. 6d. In the cable list, Callender's gained £1 to 18¼, Henleys 5s. to 21¼, and India-Rubber Ordinary ⅛ to 16⅜. Rumour continues to play an important part in the strength shown by electrical manufacturing issues, and also in that which has developed amongst some of the iron and steel shares, where Vickers and Armstrongs have been conspicuously buoyant. In the chemical group, Castner-Kellner are ⅛ higher at 3 7/16, and practically all the industrials in which anything like a free market exists are on the up-grade, the strength imparted to markets by the Italian news providing the latest source of impetus. The rubber market remains quiet, and, if anything, leans a little to the dull side.

Telegraphs and telephones maintain their strength. Westerns have now risen to 16, and stand highest in their particular section. A few Globes came in the other day, and on this the Ordinary lost 5s. Great Northerns are better at 38½. Oriental Telephones and United River Plate Telephones are both better. The Marconi group is steady. The Marine Co. declares the same dividend as that of last year, but the profits are substantially better, and the price keeps about 2 11/16, while the parent shares, after touching 3½, reacted to 3⅜. American Marconis at 23s. show no alteration on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price June 25, 1918.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅛	—	£7 13 10
Charing Cross Ordinary	5	4	3¼	—	6 3 1
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 6
Chelsea	3	5	3⅛	+ ⅛	8 0 0
City of London	8	8	11¼	—	7 2 3
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 0 4
County of London	7	7	10¼	— ⅛	6 16 7
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	5¼	—	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3¼	—	7 13 10
Metropolitan	3	4	3⅛	—	6 8 0
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 13 4
St. James' and Pall Mall	8	9	6⅞	-	6 11 0
South London	5	5	3	+ 1/16	6 13 4
South Metropolitan Pref.	7	7	21/-		6 13 4
Westminster Ordinary	7	9	6⅛	— ⅛	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94½	-	6 7 0
do. Def.	1½	1½	22	-	6 14 10
Chile Telephone	8	-	8¼		4 17 0
Cuba Sub. Ord.	7	7	9¾	—	*7 3 7
Eastern Extension	8	8	15¾		5 1 7
Eastern Tel. Ord.	8	8	159½		*5 0 4
Globe Tel. and T. Ord.	7	—	14¾	¼	*4 15 0
do. do. Pref.	6	6	10	-	6 0 0
Great Northern Tel.	24	22	38½	+ ½	5 14 0
Indo-European	13		49½	-	6 5 1
Marconi	15	-	3⅜	—	4 17 10
Oriental Telephone Ord.	10	—	4½	+ ⅛	2 5 9
United R. Plate Tel.	8	8	7½	+ 1/16	*5 6 8
West India and Panama	6d.	9d.	1½	—	*3 6 8
Western Telegraph	8	8	16	+ ⅛	*5 0 0
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	1	1	22¼	+1	4 10 0
do. District	Nil	Nil	18	+1	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	+ ⅛	Nil
do. do. "A"	Nil	Nil	5/-	—	Nil
do. do. Income	6	4	77½	+ 1	*5 4 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3	—	—
do. do. 2nd Pref.	5½	-	2½	—	—
do. do. 5 Deb.	5	5	63	—	7 18 10
Brazil Tractions	—	—	43	+2	—
Bombay Electric Pref.	6	6	9½	—	6 6 4
British Columbia Elec. Rly. Pfce.	5	5	62½	+1	8 0 0
do. do. Preferred	Nil	Nil	47½	+4	Nil
do. do. Deferred	Nil	Nil	40	+5	Nil
do. do. Deb.	4½	4½	63	—	6 15 0
Mexico Trams 5 per cent. Bonds	Nil	Nil	44	+6½	Nil
do. 6 per cent. Bonds	Nil	Nil	34½	+4½	Nil
Mexican Light Common	Nil	Nil	21	+1	Nil
do. Pref.	Nil	Nil	29	+2½	Nil
do. 1st Bonds	Nil	Nil	44	+6½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	4 9 0
British Aluminium Ord.	10	10	1 11/16	—	5 18 6
British Insulated Ord.	20	20	3¾	—	5 6 8
British Westinghouse Pref.	7½	7½	2⅝	+ ¼	5 14 3
Callenders	20	–	18¼	+1	5 16 0
do. 5 Pref.	5	5	4xd	-	6 5 0
Castner-Kellner	22	20	3 7/16	+ ⅛	5 16 0
Edison-Swan, fully paid	—	—	3⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1 3/16	— 1/16	8 8 0
Gen. Elec. Pref.	6	6	10⅜	+ ⅛	5 15 8
do. Ord.	10	10	23	+1	*4 7 0
Henley	25	25	21¼	+ ¼	5 17 8
do. 4½ Pref.	4½	4½	3¾	—	5 12 2
India-Rubber	10	10	16⅜	+ ⅛	*6 2 1
Telegraph Con.	20	20	42½	—	*5 13 0

*Dividends paid free of Income Tax.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Annual Convention.

The twenty-third annual meeting of the Incorporated Municipal Electrical Association was held at Manchester on Thursday and Friday last week, and was well attended and highly successful. The proceedings were opened in the Town Hall by the Lord Mayor, Sir Alexander Porter, who extended a hearty welcome to the visitors, whom he described as both literally and metaphorically " men of light and leading." He remarked that this was the third time the Association had met at Manchester, the presidents on the previous occasions being Mr. C. H. Wordingham and Mr. S. L. Pearce (both of whom were present at this meeting), and paid a cordial tribute to the merits of Mr. Pearce, the city electrical engineer. Alluding to the fact that the former meetings had taken place in torrents of rain, whereas on this occasion fine weather prevailed, he expressed the hope that the third time would bring luck, but, alas! the weather quickly changed, and there was plenty of rain during the session.

The President, Mr. S. J. Watson (borough electrical engineer, Bury), warmly thanked the Lord Mayor for his cordial reception, and the City Council for the use of the Council Chamber. Mr. Watson then read his presidential address, of which an abstract is given on the next page.

Bailie Willock proposed a vote of thanks to the President for his excellent address, remarking what a glorious debate they could have had on it—if it had been open to debate. Committeemen should use it to check the achievements of their engineers.

Mr. Watson acknowledged the vote of thanks, and called upon Mr. Pearce to open the discussion on " The Future of Electric Power Supply," which occupied the remainder of the sitting, and was adjourned to the following day.

In the afternoon the members visited either the works of the British Westinghouse Co. at Trafford Park or the Stuart Street Power Station of the Manchester Corporation, being conveyed to their respective destinations by special tramcars provided by the Corporation. At the former, the visitors were received by Mr. W. W. Blunt, who, in a brief address of welcome, stated that since 1909 the output of the works had increased threefold, and the number of employés now exceeded 10,000. The financial control of the concern, formerly American, had been transferred to British hands, and it was now entirely owned in England, by English interests. The company would devote its whole efforts to increased efficiency, and hoped that the good relations which now prevailed between manufacturers and customers, greatly assisted by the patience and consideration shown by the latter under trying conditions, would endure.

Amongst the many interesting machines and apparatus in course of construction in the works, we may mention especially a rotary converter for 1,500 kw. at 1,500 volts, a d.c. motor of 7,500 h.p. at 1,000 volts, and a large vertical double-acting gas engine.

At Stuart Street station, which was also open for inspection on Friday, items of special interest were the huge boilers (Babcock & Wilcox marine type, 60,000 lb. per hour), and turbo-alternators of 15,000 and 20,000 kw. The latest of these, a Richardsons, Westgarth turbine and Westinghouse alternator, has been running since May 17th on practically full load without a stop. A 25,000-kw. set of the same build is on order, and will bring the total capacity of the station up to over 100,000 kw., of which over 77,000 kw. has been added since June, 1909. The six cooling towers installed (one on order) during the same period can deal with 4,600,000 gallons of circulating water per hour. The first instalment of the 33,000-volt underground mains, the future standard voltage, is being laid between Manchester and Salford.

At the works of Messrs. W. T. Glover & Co., Ltd., demonstrations were given of the company's new patent test-sheath cable, which we describe elsewhere in this issue.

In the evening there was an excellent smoking concert at the Engineers' Club, to which the members were invited, and as far as practicable they were made free of the facilities of the club.

The discussion on " Electric Power Supply " was opened by Mr. S. L. Pearce, who remarked that the report on Coal Conservation had been dealt with in his address to the Engineers' Club, and had been practically superseded by that of the Board of Trade Committee on Electricity Supply; he gave a critical analysis of the latter, which he regarded as a reasonable compromise, based, to a great extent, on the proposals of the Lancashire and Cheshire Report; and while he found much to criticise, he strongly commended the scheme as a whole to the favourable consideration of the members.

Bailie Smith (Glasgow) one of the signatories to the report, welcomed Mr. Pearce's approving remarks, and emphasised the necessity of prompt action. Mr. S. E. Fedden paid a tribute to Mr. Pearce's illuminating treatment of the two reports, and, while he found fault with many features of the new scheme, expressed general approval of its proposals. The discussion was continued by Councillor Dymond, Mr. C. H. Wordingham—who regarded the report as epoch-making, and of the utmost importance to the industry—Mr. G. Wilkinson, Mr. R. A. Chattock, and Mr. F. W. Purse, and was then adjourned to the following day. On the resumption of the discussion, Councillor Barge, Mr. H. S. Ellis, Mr. J. W. Beauchamp, Alderman Higham, Mr. H. F. Proctor, Alderman F. W. Smith, Mr. R. Lomax, Bailie Willock, Mr. C. Turnbull, Mr. Purse, and Mr. T. D. Clothier took part, and Mr. Pearce briefly replied.

The annual general meeting then took place, and the report of the Council was discussed. Mr. J. W. Spark (West Hartlepool) uttered a strong protest on behalf of the N.E. Coast municipalities against the action of the Council in giving evidence without consultation with the members, and the President explained that the Council had to act on short notice. Mr. C. H. Wordingham strongly supported a proposal of Mr. A. C. Cramb that local centres should be formed, and outlined a scheme for the combination of the I.M.E.A., the B.E.A.M.A., and other bodies representing various sections of the industry, under the Institution of Electrical Engineers. Mr. L. L. Robinson supported the proposal, and Councillor Lindsay, who pointed out that a local Association was being formed in Scotland, in alliance with the I.M.E.A., moved a resolution to the effect that the Council should formulate a constitution for local centres, which Mr. Purse seconded, claiming it as one of his " babies." Ald. Higham suggested that the companies should be admitted, but the proposal was emphatically rejected, and the matter was ultimately referred to the Council. On the subject of salaries, Mr. Robinson drew attention to the disgraceful treatment of engineers by Councils, and moved that the Council should ask the Committee on Production (not Sir George Askwith) whether the award of £1 + 12½ per cent. did, or did not, apply to chief engineers. Councillor Barge seconded, and the resolution was carried unanimously. Mr. Wordingham drew attention to the various organisations in existence, or in course of formation, to represent sections of the industry, and emphasised the importance of unity in this matter; he urged the members to attend the mass meeting that was to be held in a fortnight's time, and to help to form a strong Association that would look after the interests of engineers.

The result of the postal ballot for the new members of Council was as follows:

President: Mr. F. Ayton. Vice-President: Mr. T. Roles. Representatives of Large Stations: Messrs. R. A. Chattock, J. W. Beauchamp, A. S. Blackman, L. L. Robinson. Representatives of Small Stations: Messrs. C. M. Shaw, E. E. Hoadley. Councillors: Bailie Smith Councillor Thompson. Hon. Secretary: Mr. H. Faraday Proctor. Hon. Treasurer: Mr. A. C. Cramb. Hon. Solicitor: Alderman Pearson.

A vote of thanks to Mr. J. E. Edgcombe for his past services as hon. treasurer was recorded, together with similar acknowledgments to the president, the hon. secretary, and other officers.

On the proposal of Mr. C. Furness, it was resolved that a general meeting should be held within six months, at Birmingham, to consider the Board of Trade Bill when drafted to carry out the proposals of the Committee on Electric Power Supply.

The proceedings then terminated.

Presidential Address.

By S. J. Watson.

(*Abstract.*)

The Association numbers amongst its members the engineers and municipal committees representing the administration of undertakings having a capital expenditure of over £60,000,000, and an annual income approaching £10,000,000.

The practicability of arranging for members of the Association to form local sections has been considered by the Council on more than one occasion during recent years. Several local associations, consisting usually of the engineers of supply undertakings, have been in existence for some time in London and certain provincial centres, and have carried out useful work by appointing committees to consider and report on such questions as interconnecting supply systems.

Closer co-operation between the Council and members is desirable, and the first step to take is to get into touch with those local organisations of engineers or representatives of undertakings which already exist with a view of forming such organisations into local sections of the I.M.E.A.

The establishment of strong local sections endowed with a large measure of local autonomy, working in conjunction with a Central Federated Council, nominated partly by each local section and partly by unattached members, would ensure a much greater interest in the work carried on, as there would be a closer relationship between the Central Council, the local sections, and members generally than is possible under present conditions.

However we may agree with or differ from the findings of the Coal Conservation Sub-Committee, I believe we all realise that existing methods require overhauling, as the future manufacturing prosperity of the nation must almost, if not entirely, depend on the provision of a cheap and reliable supply of electrical energy.

Supply undertakings have played no small part in the nation's activities during the last three years by enabling manufacturers immensely to increase their output of essential articles and by facilitating the establishment of new factories, and the usefulness of a centralised supply has been more fully demonstrated than might otherwise have been the case. Still greater benefits would have been derived if some of the contemplated extensions to power stations had been carried out during the early part of the war. Through the inability of undertakings to meet all demands many antiquated private plants have been re-started which would otherwise have been scrapped, second-hand inefficient machinery has been brought into use, and in many cases important engineering shops, capable of turning out work of a more vital character, have been engaged on the production of small prime movers. This has led to a waste of fuel, increased transport, and to the additional employment of labour which might have been avoided.

Census returns show that Great Britain, with a population of 45,000,000, employs power to the extent of 10,750,000 h.p., including 2,000,000 h.p. used by public utility undertakings, leaving 8,750,000 h.p. for manufacturing purposes, say an average of approximately 1 h.p. to five inhabitants. In parts of industrial Lancashire the amount far exceeds this figure; in some cases it is as high as 5 h.p. to eight inhabitants. In the area of 400 square miles with Manchester in the centre and a population of 2,500,000, it is safe to take the power requirements at 1 h.p. to two inhabitants, say a total installed capacity of 1,250,000 h.p., or 750,000 kw. Allowing for diversity of usage, this would represent a maximum demand of approximately 450,000 kw.

In this area there are 18 statutory electricity supply undertakings possessing generating stations, and as all of these were in operation prior to 1905 I have ascertained the progress made in the use of the public supply between that year and 1915.

The capital expenditure increased from £4,170,000 to £6,662,000, the plant capacity from 58,750 kw. to 184,850 kw., the maximum load from 38,800 kw. to 111,700 kw., the units sold from 65,250,000 to 260,500,000, the income from £520,000 to £1,095,000, and the working expenses from £240,000 to £595,000.

With an increase of 60 per cent. in the capital expended the plant capacity has been increased by 215 per cent; with an increase of 190 per cent. in the maximum load the output has increased by 300 per cent., the income by 110 per cent., and the working expenses by 148 per cent. It is evident that extensions have cost very much less than the original plant, and that the additional output has been sold at cheap rates effecting a marked improvement in the load factor, and consequently in the cost per unit supplied.

The output for different purposes with the maximum load for 1905 and 1915 was as follows:—

	1905		1915	
	Units sold.	Maximum load.	Units sold.	Maximum load.
Lighting	9,000,000	8,400 kw.	21,000,000	18.200 kw.
Tramways	37,000,000	22,600 kw.	61,000,000	30,000 kw.
Power	19,000,000	7,800 kw.	178,000,000	63,500 kw.
Totals	65,000.000	38,800 kw.	260,000 000	111,700 kw.

The total maximum demand for industrial power in the area is estimated at 450,000 kw. It might therefore be assumed that as the maximum load amounted to 63,500 kw. in 1915, about 14 per cent. of the possible demand was already being given. Closer investigation shows, however, that a very large proportion of the demand for power is due either to extensions of existing works or to the establishment of new industries. In these cases electrical driving has not been substituted for any other form of power, but has enabled extensions to be carried out or new works to be equipped without adding to the numbers of isolated plants.

It has been estimated that the average coal consumption throughout the country is from 5 to 7 lb. per h.p.-hr., and the statement may quite possibly be correct, but I am quite sure it is not true so far as this particular district is concerned.

As electrical driving has already superseded a large proportion of the small private plants, the average size of the remaining plants is comparatively high, and the majority of the engines are of the slow-speed reciprocating type. There are no keener engineers in the country than those responsible for the design and operation of this class of prime mover, and excellent coal consumption figures are obtained. Under these circumstances, the process of obtaining the larger manufacturers as consumers is somewhat slow. It is not until the engines or the boilers require replacing that the question of changing over is seriously considered. There are, however, many instances during the last few years where even the largest concerns, after the most careful investigation, have decided to scrap their own plant and purchase the whole of their requirements from the outside source. An increase of 840 per cent. in the units used for power purposes between the years 1905 and 1915 clearly indicates the growing confidence in electrical power supply.

Assuming an ultimate demand of 450,000 kw. and a load factor of 50 per cent., which is well within the range of probabilities, the total output required for industrial power purposes will amount to 2,000,000,000 units per annum, excluding any supplies to railways or new industries. A further field for the use of the supply lies in the substitution of electrical heating and cooking apparatus for the existing domestic fires. The consumption of coal for this purpose amounts to about three-quarters of a ton per individual per annum, or, say, nearly 2,000,000 tons in this area, all of which is burnt in notoriously inefficient open grates. This quantity of fuel if consumed at a power station would enable upwards of 2,000,000,000 units to be supplied to meet these requirements. Provided a low scale of charges is adopted, and reliable heating appliances are available at a reasonable cost, there seems no reason why this important duty should not be carried out electrically.

After making some provision for railway electrification, the establishment of new industries, and domestic developments, it is not at all improbable that the total electrical requirements will amount to 5,000,000,000 units per annum at the end of the next two decades, with a maximum load approaching 1,000,000 kw.

My sole object in mentioning these figures is to bring home to all our members the importance of the problem awaiting solution in the near future. We have reached an epoch in the history of electricity supply, and if the greatest possible use is to be made of the most important national asset, *i.e.*, coal, it is essential that a long view should be taken of the position.

(*To be concluded.*)

Electric Power Supply.

Opening the discussion on the report of the Board of Trade Committee, Mr. S. L. Pearce said the subject was of the greatest importance; the report of the Coal Conservation Committee, which had been superseded by the one under consideration, had been open to objection on the score of its disparagement of the work of local authorities, wholesale condemnation of existing plant, proposed stoppage of extensions at existing stations in favour of the erection of new superstations, and its suggestion that private enterprise was better fitted for the future conduct of the business. Transmission was a most vital factor in any scheme for reorganising the supply industry. Referring to his address before the Engineers' Club,* Mr. Vernier had questioned the accuracy of his figures, mainly on the ground that he had considered only point-to-point transmission, whereas in practice there would be sub-stations on the route of the mains. For point-to-point transmission he had, if anything, under-stated the case; if there were any deviation from that system, the capital cost would obviously be increased, and a large amount of underground cable would be laid, with perhaps a second transformation. He was not sure that a distributing system would show up so well. In general, Mr. Vernier agreed that future generating stations would not be more than 20-25 miles from the load. It was interesting to note that Mr. Vernier pronounced in favour of underground cables, at the highest possible pressure, for main transmission lines, only local lines being overhead. The highest pressure likely to be adopted on overhead lines in this country was 66,000 volts. A good case could be made out for underground cables at high pressure, allowing for the higher depreciation and maintenance of overhead lines. Turning to the report of the Board of Trade Committee, he expressed very great satisfaction with the fact that it was unanimous. The report was of the nature of a compromise; there was no one definite conclusion laid down for the whole country—the report was very flexible. Reviewing the principal recommendations, Mr. Pearce said that one of the most important points was the retention by existing undertakers of full powers of distribution. In contrast with the Coal Conservation report, the principle of public ownership was advocated, the amalgamation of existing interests was preferred to the formation of a new organisation, and the proposals were framed more on the lines of existing conditions; there was no suggestion of the establishment of super-stations and long transmission lines. It was left for the District Boards, under the supervision of the Commissioners, to decide what should be done with regard to the local conditions. The proposals were just to the interests involved, and offered a reasonable solution to the problem; he hoped they would be accepted by municipal engineers. Certainly they would be welcomed by the majority of the engineers who signed the report of the Lancashire and Cheshire Committee,* from which so many of the ideas were adopted in the Committee's report. A case had been established for the organisation of a broad network under unified control. The amalgamation of company and municipal interests was necessary, and the Boards should be small and compact. The proposals in the report were altogether admirable; he hoped that in working out the scheme the largest measure of local autonomy would be given to them. The whole of the Boards should be financed by the State. With regard to distribution, every statutory authority could retain it in its own area, and the provisions in respect of bulk supply offered reasonable safeguards. There must be some cases in which supply would be given to consumers from the high-pressure main transmission lines of the District Boards, which in such cases should pay reasonable compensation to the local authority in respect of the customers concerned. Having pronounced in favour of District Boards, he asked why the Committee admitted the principle of "contracting out," which if applied to local authorities must also be given to companies. The financial terms proposed would fall unfairly on different undertakings, some of which had made adequate provision for the future, while others had distributed their profits in aid of the rates—a proceeding which he was glad to see condemned by the Committee. There was much to criticise in the report, but much that could claim the support of municipal engineers. Now was the psychological moment to secure legislation to solve our problems—if not now, never! He hoped the members would not turn down the proposals on the score of interference with their local autonomy; changes must be made in the national interests, and would affect both large and small undertakings. It was the duty of local authorities to look at the problem as a whole, and give the proposals a fair trial. A large amount of capital would have to be expended, and a considerable period would elapse before the scheme could be carried to completion—therefore they should start at once.

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* Elec. Rev., March 22nd. 1918.

Bailie **Smith** (Glasgow), a member of the Committee, was glad to hear how much Mr. Pearce had to say in favour of the report. The conclusions arrived at by the Committee were based on seven months' evidence, not on preconceived opinions, and represented an attempt to be fair to all parties. The I.M.E.A. might feel that some parts might be strengthened, others modified or omitted; but this was the result of give and take between two parties which viewed the problem from opposing points of view. Delay would mean not only loss of money, but a serious handicap to industry—*they must be ready when peace returned*. The principal feature of the report was the unanimous conclusion that the generating stations and main transmission lines should be publicly owned; the local authorities must decide for themselves whether to undertake the distribution or lease it to a company. Flexibility was a strong point of the report; no Committee could tell what exceptions might arise, and the intention was to provide against unforeseen circumstances. Paragraph 55 enabled a large local authority or company to continue supplying in its area, and paragraph 56 met the case of small isolated areas, in which the Commissioners could exercise a dispensing power. No payment would be made for goodwill; this might appear unjust to many concerns, but they must take the whole country into consideration, and they would reap the benefit in low costs. With regard to paragraph 70, relating to compensation for loss of office, the evidence before the Committee showed that the probabilities were all the other way; the increase in the demand would be far beyond what any of them imagined. For example, all urban railways would probably be compulsorily electrified, and the system would very soon be extended to the main lines. There were many other openings, and more men would be wanted, not fewer. The system of rating electrical undertakings was absolutely obsolete, and must be rectified. The erection of super-stations was not contemplated; the District Boards would put up stations where they were required. The report would appeal to their support, and he hoped they would back the Bill of the Board of Trade.

Mr. S. E. **Fedden** (Sheffield) thanked Mr. Pearce for his illuminating commentary on the report, and his splendid criticism of the Coal Conservation report—a fallacious document which should never have been printed. With regard to long-distance transmission, he satisfied himself 16 years ago that it did not pay to go far out of Sheffield; two years ago the question cropped up again, and he investigated the cases of stations 10 to 40 miles away. Comparing a station on an ideal site as regarded coal and water, outside Sheffield, with a station in the city, on the basis of 66 per cent. load factor, 0.8 power factor, 100,000 kw. capacity, he obtained the following figures for the cost of production:—

Distance.	Voltage.	Pence per unit.
1 mile (cooling towers) ..	11,000 volts	0·275
10 miles away	33,000 v. underground	0·274
20	.. ..	0·314
20	30,000 v. overhead ...	0·304
30	40,000 v. ..	0·331

The main cables of any large scheme should be underground, with overhead lines locally. He concluded that he could put down a power station near the concentrated load, with cooling towers, and supply at 20 per cent. less than from an ideal station 30 or 40 miles away. Stations larger than 100,000 kw. presented difficult problems owing to the immense quantities of water, coal, and ashes to be handled at one spot, as well as the number of outgoing mains. The recommendations of the later report would make for the good of the nation in the long run, but some undertakings would suffer in the meantime; if a large undertaking had to take over a number of small over-capitalised concerns, the cost would be considerably increased for a time. The decision to leave the distribution to the local authorities was welcome. Clause 54 might result in large private consumers getting control and guiding matters in their own interest; the safeguards were totally inadequate. With representation proportional to consumption, some of his consumers would command hundreds of votes, and combinations might be made which would outweigh the local authority. Clause 55 seemed to be framed in the interests of the North-East Coast companies; would a municipality undertake the responsibility of financing an area 20 miles around its borders? The possibility of supplying consumers from the trunk mains needed watching; if his large consumers were taken, he would lose interest in the small ones. The financial proposals were most unfair; they penalised thrift. Those who had husbanded their resources, and those who had reaped kudos by aiding the rates, were treated alike—it was most unfair.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Association of British Electrical Engineers.

In a footnote to the report of the Leeds "mass meeting" in your current issue (page 584), you state that at the Birmingham meeting the resolution was carried and delegates were appointed.

I am, of course, unaware of the nature of the report which you propose printing more fully in your next issue, but should like, on behalf of the E.P.E.A., to amplify the above statement.

Primarily the resolution was carried, after severe criticism, owing to the appeal of the chairman that, inasmuch as there were present engineers who were not members of the E.P.E.A., it was desirable to express approval of the principle of a protective organisation, and, further, that he would be quite agreeable to the passing of further resolutions.

It was then carried unanimously:—"That the proposed Association be constituted in the existing E.P.E.A." Of four delegates elected, two were members of the E.P.E.A., one of whom was the Midland Divisional Secretary.

G. P. Sutton,
Hon. Publicity Secretary.
Electrical Power Engineers' Assn., Midland Section.

Birmingham, *June 22nd*, 1918.

The I.E.E. and E.P.E.A.

As a member keenly interested in the welfare of both these bodies, may I appeal to all qualified electrical engineers to take a less biased path to the ultimate co-ordination of our desires? There do not seem to be many difficulties if we but consider as our object:—"The establishment of an Institution such as would be embodied in a reconstructed I.E.E. acting under a Royal Charter with views and activities such as are represented by the British Medical Association."

It seems to be a *sine qua non* that all qualified electrical engineers would desire to become members of this super-I.E.E. Now there would appear to be two established bodies together covering the whole of this ground, and representative of the industry. These are:—

Academically.—The I.E.E.

Financially, politically, socially, &c.—The E.P.E.A. for the station engineers; the B.E.A.T.A. for the manufacturing engineers.

These two latter Associations are in mutual agreement. Now let the I.E.E. recognise the E.P.E.A. and *vice versa*, as the governing body relative to their different scopes until such time as the Royal Charter is sanctioned. In the meanwhile, let each carry on its respective duties with, in place of the much-discussed A.B.E.E., a council of members of both associations as a medium through which each can express views, opinions, and even advice. Eventually, with the sanction of the Royal Charter, we could establish a super-A.B.E.E., and the situation would become :—

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* Elec. Rev., August 17th, 24th, and 31st, 1917.

Royal Charter A.B.E.E.—Power supply and public utility, the E.P.E.A.; academic, the I.E.E.; manufacturing section, the B.E.A.T.A.; which surely covers all needful requirements.

Now to deal with the I.M.E.A. and the A.M.E. (Greater London), I suggest that they cannot become national as the one is sectional, and the other parochial. Nevertheless, they can still carry on their rightful and useful functions, but to them and to the C.T.A.A., in view of the report of the Whitley Committee, I would recommend that their efforts are best confined to academic affairs, leaving industrial questions to the national associations.

In conclusion, a word to individuals :—To I.E.E. members who have not supported the E.P.E.A., the Whitley Report cuts the ground away from under your feet, for a registered union is a necessity, not merely *infra dig*. To E.P.E.A. men who joined not the I.E.E., or who lapsed, and now blame the I.E.E. for its purely academic powers—would not the members of the much-admired British Medical Association have been in a similar position if their rank and file had given their executive the poor support you have accorded the Council of the I.E.E.?

T. Mason.

Ocker Hill, *June 22nd*, 1918.

Telephone Calls.

May I be permitted to make a suggestion through the medium of your journal in regard to telephone work? Suppose one has to ring up 357, for instance. How many times will the switch girl give 397? Very often, I am sure. Just to-day I wanted 75 on a certain exchange and got 79. Now it is not the fault of the switch-girl, nor of the caller; it is the fault of the telephone that it blurrs the already fine difference in sound between the words "nine" and "five"; this needs no scientific proof, as I am sure that everyone reading this letter will corroborate these statements.

Now it would be an extremely simple matter to adopt the following plan :—

1. When the caller wants, say, 79, his words are "seven nine."

2. When he wants 75, he says "seven F." Thus, if he wanted Central 1,205, he would say "One two O F."

The switch-girl would immediately recognise on hearing "F" that 5 was required, even if she were not previously instructed, as I have proved to my satisfaction.

It seems to me that the above presents an extremely simple way out of a well-appreciated difficulty, and if the authorities take it up they will earn the gratitude of subscribers, and find their own system working more smoothly.

Arthur Lawton.

Wolverhampton, *June 20th*, 1918.

[Our correspondent's suggestion appears to be very good. The trouble it is meant to remedy is a familiar and exasperating one.—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,480. "Ignition plugs." A. Watkins. June 10th.

9,495. "Controlling means for electromagnetic feed-reel brakes." H. V James. June 10th.

9,525. "Ignition magneto switches for internal-combustion engines." G Martire. June 10th. (Italy, June 8th, 1917.)

9,562. "Telephone systems." H. M. Friendly. June 11th. (U.S.A., June 11th, 1917.)

9,578. "Manufacture and adjustment of contact plates in Swan lamp bases." H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. June 11th.

9,579. "Appliance for facilitating re-energisation of luminous paint surfaces by means of electric torch." A. B. Gibbons. June 11th.

9,582. "Incandescent electric lampholders or sockets." B. M. Drake and Drake & Gorham. June 11th.

9,601. "Regulating [illegible] electric machines." Bosch Akt. Ges. and O. Imray. June 11th.

9,620. "Electro-dynamical devices for purification of waste lubricating oil." F. J. Kean. June 12th.

9,622. "Electrolytic apparatus." Sir H. Rogers & C. M. Walter. June 12th.

9,628. "Electric switches." J. B. Tucker. June 12th.

9,641. "Heating oils, fats, &c., by electricity for distillation, &c." A. Imbrey & H. Alexander. June 12th.

9,651. "Magnetos." A. E. Lamkin. June 12th.

9,678. "Electric switches." Edison Accumulators, Ltd., E. W. Lewis and J. F. Monnot. June 12th.

9,735. "Electric switches." British Thomson-Houston Co. (General Electric Co., U.S.A.) June 13th.

9,740. "Ignition systems for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. June 13th.

9,750. "Electric motor-control systems." British Westinghouse Electric and Manufacturing Co. June 13th. (U.S.A., June 13th, 1917.)

9,751. "Control of electric motors." British Westinghouse Electric and Manufacturing Co. June 13th. (U.S.A., June 13th, 1917.)

9,754. "Telephones or microtelephones." R. A. Baron van Lynden and Naamlooze Vennootschap De Nederlandsche Thermo-Telefoon Maatschappij. June 13th.

9,773. "Solenoids." E. Stirk, G. Stirk, J. G. Stirk & R. Stirk. June 14th.

9,788. "Sparking plugs." J. F. Barrows. June 14th.

9,791. "Means for electrically operating [illegible]." J. [illegible] June 14th.

9,822. "Crucibles for electric furnaces." Morgan Crucible Co. & C. W. Speirs. June 14th.

9,828. "Vibrating switches or contact breakers for induction coils, &c." H. J. Stenning and H. W. Cox & Co. June 14th.

9,829. "Adjustable contact screws for contact-breakers, &c." H. W. Cox and Co. & H. J. Stenning. June 14th.

9,831. "Electric generators and motors." L. [illegible]. June 14th.

9,836. "Utilisation of high-frequency oscillations in wireless stations." D. W. Brown. June 14th.

9,871. "Magneto motor." D. Suchostawer. June 15th.

9,872. "Inductor magnetos." W. H. Nix. June 15th.

9,887. "Glass bulb cutting machines." General Electric Co. & British Thomson-Houston Co. June 15th.

9,898. "Electric accumulators." C. L. Breeden & H. Lucas. June 15th.

9,901. "Electric furnace." P. Forster. June 15th.

9,905. "Ignition devices for water-cooled explosion motors." A. Isliker and Motosacoche Soc. Anon. June 15th.

9,906. "Portable electric batteries or cells." G. Harrop. June 15th.

PUBLISHED SPECIFICATIONS.

1917.

1,277. Process for the Manufacture of Thermo-elements having Copper Sulphide as the Positive Constituent. J. Marschall. December 9th, 1915. (103,671.)

4,885. Manufacture of Plates for Electric Storage Batteries. H. Wade (L. H. Flanders). April 4th, 1917. (115,865.)

5,072. Electrically-heated Resistance Furnaces. H. A. Greaves & H. Etchells. April 11th, 1917. (115,866.)

6,425. Commutating Devices for Internal-combustion Engines. E. G. A. Churchman. October 24th, 1917. (115,871.)

7,197. Variable Electric Inductances. J. S. E. Townsend. May 18th, 1917. (115,876.)

7,202. Ignition Devices for Internal-combustion Engines. G. Roesch and Clement Talbot, Ltd. May 19th, 1917. (115,881.)

7,337. Loading Coils for Telephone Circuits. British Insulated & Helsby Cables, Ltd., G. E. Barstow & H. H. Harrison. May 21st, 1917. (115,895.)

7,368. Electric Couplings. Sopwith Aviation Co. & H. E. Cato. May 22nd, 1917. (115,898.)

7,430. Four-stroke Cycle Explosion or Internal-combustion Motors provided with Magneto Ignition Apparatus. C. A. Hult & O. W. Hult. May 23rd, 1917. (115,901.)

7,461. Electrical Water-heating Apparatus. J. F. Barr. May 24th, 1917. (115,904.)

7,510. Electric Flat Irons. C. S. Palmer & D. Palmer. May 24th, 1917. (115,908.)

7,558. Device for Forming Electric Arcs. Dubilier Electrical Syndicate. August 15th, 1916. (108,851.)

7,562. Devices for the Lighting, Heating, and the like of Vehicles. Maschinenfabrik Oerlikon. May 25th, 1916. (106,826.)

7,900. Telegraph and like Poles. W. G. Young & F. Downes. June 1st, 1917. (115,916.)

9,080. Method of Recording and Reproducing Simultaneously Movements and Sounds. H. Pedersen. June 25th, 1917. (115,942.)

9,134. Electrical Switches. H. W. Cox & J. H. Cowell. June 26th, 1917. (115,943.)

9,153. Devices for the Speedy Fixing of Fuse Wires to Electrical Installations. R. A. Kerman & T. Mathias. June 26th, 1917. (115,944.)

9,816. Multipolar Magnetos for Electric Ignition Systems. W. J. Mellersh-Jackson (Bosch Magneto Co.). July 6th, 1917. (115,949.)

11,064. Conductive Clamps for Electrodes of Electric Furnaces. A. Oates. August 1st, 1917. (115,973.)

14,759. Electric Junction Boxes. F. Moor & Callender's Cable & Construction Co. October 12th, 1917. (116,016.)

17,018. High-tension Ignition Magnetos. G. A. Chailliey. June 5th, 1917. (116,032.)

18,281. Liquid Rheostats. British Westinghouse Electric & Manufacturing Co. December 9th, 1916. (112,434.)

18,796. Automatic Telephone System. Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) December 18th, 1917. (116,039.)

19,289. Light Diffusers for Vehicle Lamps. Steward-Warner Speedometer Corporation. September 22nd, 1917. (116,044.)

1918.

3,705. Illumination of Gauge and Glass Tubes. Vickers, Ltd., J. McKechnie & A. H. Robinson. March 2nd, 1918. (116,062.)

4,366. Magnetos. G. A. Chailliey. December 29th, 1917. (116,064.)

Syndication in the Brass Industry.—We are informed that considerable interest is being taken in the scheme of syndication prepared and placed before the various firms in the brass industry by Mr. Howard F. Smith, of Birmingham. It is hoped that before long things will assume a definite shape. Particulars are being circulated, not only to every firm both large and small, but also to most of the recognised Trade Associations in Great Britain which are in any way interested in the industry. We understand that the proposal is for a 51 per cent. financial merger of all the firms taking part, each firm retaining 49 per cent. only of its own capital. On this principle the profits are to be pooled and allocated and a revaluation of each firm is to be made every three years in order to level up matters in regard to those firms showing initiative and progress, and others which by reason of apathy are not contributing their due proportion to the combine.

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